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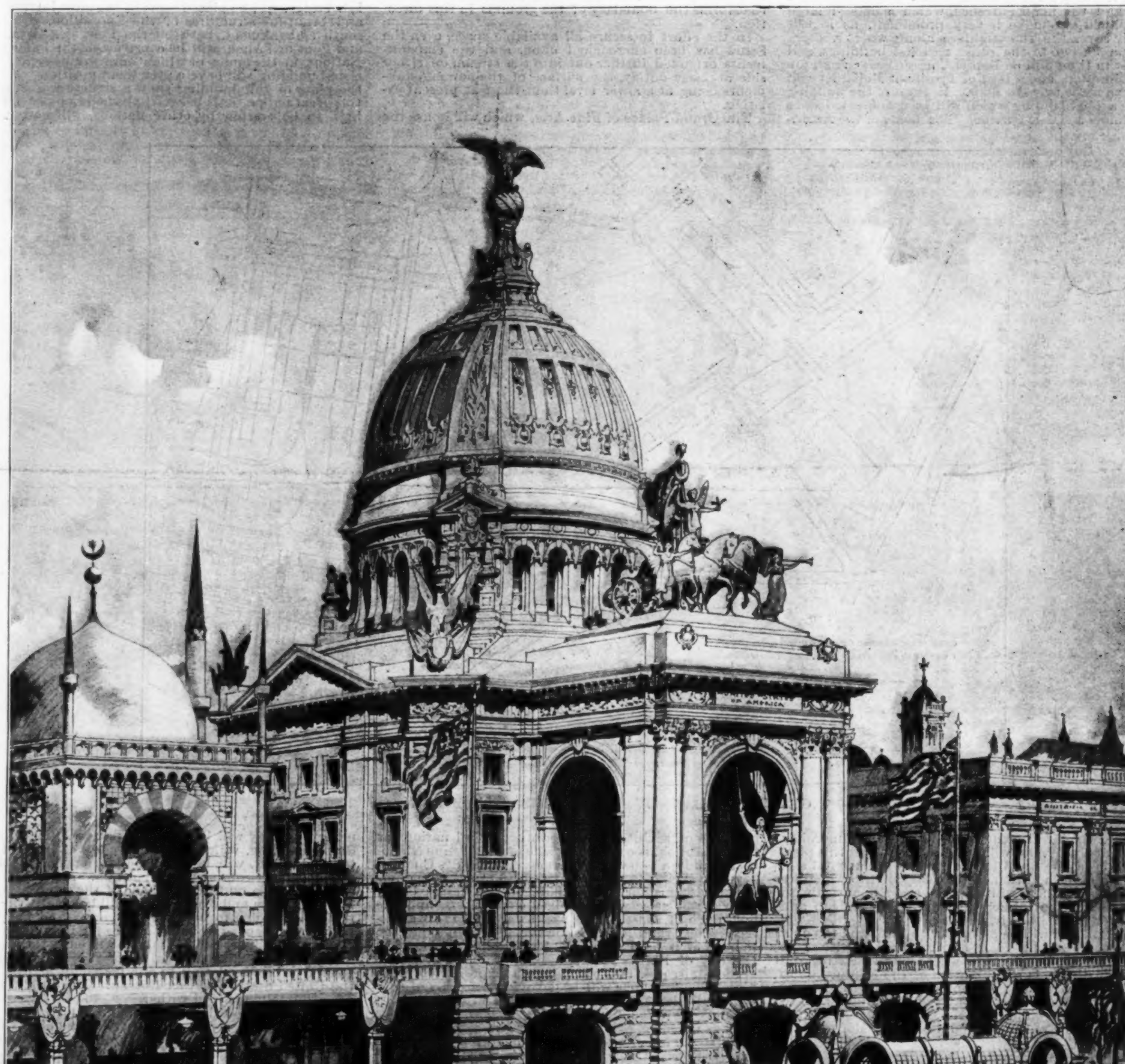


THE UNITED STATES NATIONAL PAVILION AT THE PARIS EXPOSITION.

COOLIDGE & GOUSTIAUX, ARCHITECTS.

THE UNITED STATES PAVILION AT PARIS.

AMONG the most pleasing buildings at the Paris Exposition will be the United States National Pavilion, on the Quai d'Orsay, on the left bank of the Seine, where it will be among the buildings of the other great powers. It will be in striking contrast to the rather florid and overblown architecture of the Exposition.

The building itself will be square, with a large central dome and rotunda, which will be used as a general meeting place of Americans during the Exposition. Three sides of the rotunda have rooms 13 by 36 feet opening out of it, which will be used as lounging rooms. The second story will be given up to the States, and here people can also rest and register their names. The third story will be devoted to private offices for the commissioner-general and staff. The fourth floor will be given up to the States to be used in the same manner as the second.

There are two American electric elevators. The building measures 85 by 90 feet and will be 165 feet from the lowest level.

In a general way the building suggests, without imitating, the Capitol at Washington and the Administration Building at the World's Fair. The architect has tried to give it prominence, notwithstanding the narrow space imposed by the site. It will probably be the only structure in that row which has a high dome, and the main entrance, which is under a large portico, will also make it very prominent, as it will entirely cover the thoroughfare along which visitors must pass to go to the other national buildings, and directly in front will be Daniel Chester French's statue of Washington, and a bust of President McKinley will occupy a niche over the door. In front of the building will be a boat landing which will be ornamented so as to resemble a classic trireme. The boats of the American line, which will connect with the American trolley system at Vincennes, will make a landing at this pier. The style of the architecture is richly ornamental and classic, and, in addition to the sculpture, to which we have referred, there will be eagles and a quadriga with a "Victory;" the former will be by Mr. Flanigan and the latter will be by Mr. Proctor.

The building will be covered with staff, and the only place where strong color may be used is within the great arch at the entrance, where mural painting will be adopted. It is the intention of the commission to employ the best mural painters in America for the artistic treatment of the interior of the building. The architect of the building is Mr. C. A. Coolidge, of Boston, and his French collaborator is M. Morin Goustiaux.

THE PARIS EXPOSITION OF 1900.

THE grounds of the Paris Exposition of 1900 lying within the city comprise four plots or tracts, two of which, the Champ de Mars and the Esplanade des Invalides, are situated south of the Seine, with two lesser tracts, the Trocadero grounds and the site of the Art Palaces, situated on the north side of the Seine. The main tract, the Champ de Mars, and the Trocadero grounds just across the Seine, are connected by the Pont d'Iéna, and thus form one section. A second section is formed by uniting the Esplanade with the plot taken from the city park system, the two being united by the beautiful Alexander III. bridge, in process of construction. These two sections are connected along the Seine by considerable spaces on either side of the river, formed by the Seine embankments, and on the south side by taking in Quai d'Orsay, one of the city streets. While the several sections are almost in the heart of Paris, with blocks of buildings and systems of streets between, it will be possible to fence the grounds into one inclosure, with gates at different points, so that one ticket will admit to all parts of the grounds. It should be mentioned that another section of the Exposition will be located in Parc Vincennes, eight miles distant, though directly connected with the Exposition grounds by rail, with rapid trains running at short intervals.

The main entrance to the Exposition proper will be near the Place de la Concorde, and, therefore, only a short distance from the garden of the Tuileries. The eastern sections of the grounds nearest to this point are to be connected by a magnificent piece of permanent engineering work over the Seine, to be known as the Alexander III. bridge. Upon the large tract extending along the north bank of the river, which was acquired by using a portion of the park system between Cours de Reine and the Avenue des Champs Elysées, and including the site of the now demolished Palais l'Industrie, two superb palaces of art are in process of construction, which are to be permanent. To make room for these immense structures it was necessary to sacrifice the old Palais l'Industrie, and, to make the buildings themselves more imposing, a new thoroughfare is to be established, the Avenue Nicholas II. Starting from the Avenue des Champs Elysées, this thoroughfare will pass between the two art palaces, upon which they will front vis-à-vis, and, crossing the Seine by means of the new Alexander III. bridge, will extend the entire length of the Esplanade des Invalides in a straight line, ending at the Exposition building that forms the boundary of the grounds in this direction.

In the effort to secure all available space, even the Seine has been encroached upon, and the embankments extended further out into the stream on either side at large outlay, the surface of the new embankments being at a lower level than those at present existing.

The Grand Palace of Fine Arts, which will house the treasures of sculpture and painting of all nations at the Exposition, is on the west side of the Avenue Nicholas II. and quite near the famous Avenue des Champs Elysées. Prizes to the value of 45,000 francs were offered for designs for this building. The design of M. Louvet was selected from sixty competitors, and the first prize of 15,000 francs was awarded to this architect. The Grand Palace is constructed of cut stone, the same that is used so largely for building purposes in the city of Paris. The palace is provided with two grand staircases, and will have an imposing entrance hall. The first floor will be devoted to a series of superb exhibition rooms for paintings, and an enormous salon is provided for sculpture. There will also be suites of smaller exhibition rooms, besides a café and other rooms for entertainment or comfort of the Exposition visitors. Ample arrangements have been made for lighting all of these exhibition rooms, the upper ones, of course, being lighted from the roof.

The lesser Palace of Art, known as the Girault Palace, from the name of the architect whose design was accepted, occupies a position on the east side of the Avenue Nicholas II. It will be a permanent structure similar to the Grand Palace in materials and general style, and will be devoted to historical treasures, a part of the grand retrospective exhibit which is the raison d'etre of the exhibition of 1900; that is, to show to the world the progress of the past hundred years.

It is the intention of the Exposition authorities to beautify the grounds surrounding the Palaces of Art in such a manner that the landscape will connect naturally with existing shrubbery and trees, giving a parklike aspect, which will harmonize with the famous promenade, the Avenue des Champs Elysées, immediately to the north.

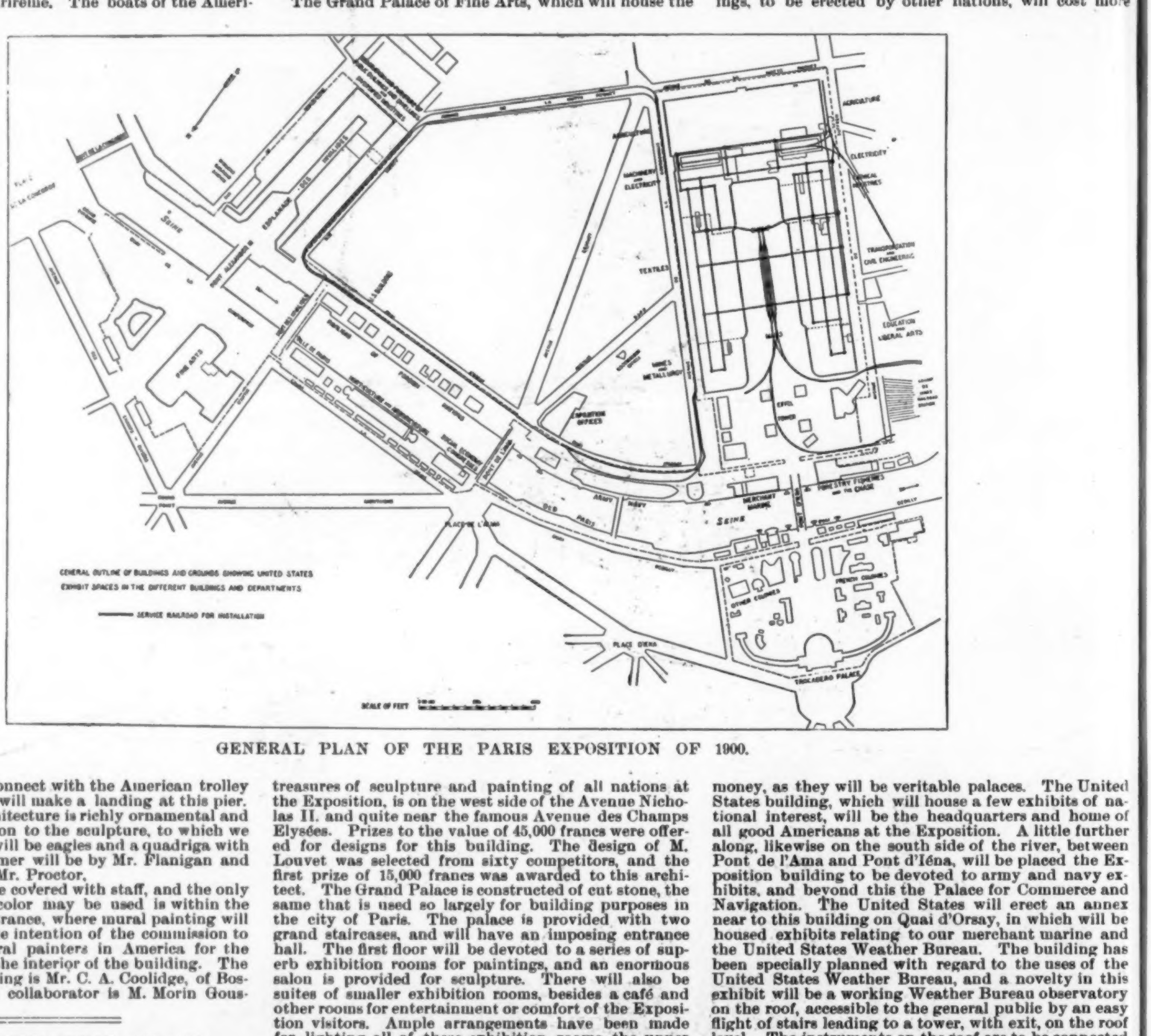
Passing from this grand promenade and drive, through the new Avenue Nicholas II., to a point south of the Art Palaces, the visitor comes to the Seine, and to the extensive works now in progress on the new Alexander III. bridge, which will doubtless be one of the architectural features of the Exposition. The corner stone of this structure was laid in October, 1896, by the Czar of Russia. The architects of the bridge are Messieurs Cousin and Cassien-Bernard, while the construction is under the immediate supervision of Messieurs Resal and Alby. It is to be a single span bridge, 110 meters in length over all, with a width of 40 meters. While the main arch, naturally, will be of steel, the foundations will be of granite, though other stone will be used in the structure, even marble, in connection with bronze, with which some very beautiful ornamental effects will be produced. The general style is Louis Quatorze, with many statues and decorations, some of the models for which it was my pleasure to see in the workshops of the Exposition. Among the artists represented are Fremiet, Dalon, Gardet, Cordonnier, and others. During the construction period an iron foot bridge will span the Seine, just beneath which the work will go on. This foot bridge was built in sections and "thrown" or "launched" into position from the north side of the river.

The series of palaces on the Esplanade des Invalides will be devoted largely to exhibits in manufactures and the various industries. The United States have secured ground space in this portion of the Exposition, near the Alexander III. bridge, upon which to erect a building.

On the Seine embankment, west of the Alexander III. bridge, will be placed some of the most interesting and beautiful structures of the Exposition. On the south embankment, between the Pont des Invalides and Pont de l'Alma, will be constructed the Palaces of Nations, in the midst of which our own beautiful national building will have a prominent position. While the plans of this building show a structure worthy of this great nation, it is believed that one or two buildings, to be erected by other nations, will cost more money, as they will be veritable palaces. The United States building, which will house a few exhibits of national interest, will be the headquarters and home of all good Americans at the Exposition. A little further along, likewise on the south side of the river, between Pont de l'Ama and Pont d'Iéna, will be placed the Exposition building to be devoted to army and navy exhibits, and beyond this the Palace for Commerce and Navigation. The United States will erect an annex near to this building on Quai d'Orsay, in which will be housed exhibits relating to our merchant marine and the United States Weather Bureau. The building has been specially planned with regard to the uses of the United States Weather Bureau, and a novelty in this exhibit will be a working Weather Bureau observatory on the roof, accessible to the general public by an easy flight of stairs leading to a tower, with exit, on the roof level. The instruments on the roof are to be connected with those displayed in the exhibit hall below, in order that the public may be able to study every phase of weather observation and forecasting, including preparations for publication and the printing of daily reports.

Another prominent building, just beyond the Merchant Marine, is the Forestry and Fisheries building, almost under the shadow of the Eiffel Tower. On the north bank of the Seine, opposite to the palaces of the foreign powers, will be located the Palace of Horticulture and the Palaces of Social Economy and the city of Paris. The United States will have a very desirable location in the Horticultural building, and extensive arrangements are being made for the exhibits in this special department.

The work upon the new Seine embankments, upon which the buildings bordering the Seine will be constructed, has been in progress for many months. Just beyond the proposed limits of the new embankment in the river double lines of piles are driven a few feet apart and parallel with the shore. The space between



GENERAL PLAN OF THE PARIS EXPOSITION OF 1900.

is then filled in and a bulkhead is thus formed. Other bulkheads are raised at intervals, running from the main line of piles to the shore, and, after pumping out the water which fills a particular section, the masonry work was begun.

We have now reached the main portion of the Exposition, which may be designated as the Eastern Section, and which includes the Champ de Mars and the Trocadero grounds. The latter plot, lying north of the Seine, will be devoted to the groups of buildings forming the Colonies Exhibits, some thirty in number, not including the Palace of the Trocadero, which was erected for the Exposition of 1878.

By far the larger portion of the Champ de Mars is covered by a series of palaces, practically under one immense roof system, which will house the following groups of exhibits: Agriculture and food products, machinery and electricity, textiles and clothing, mines and metallurgy, chemical industries, civil engineering, education, science and arts, etc. Just north of this series of connected palaces stands the Eiffel Tower, to the left of which is the palace devoted to the monster telescope, illustrated in a recent number of the SCIENTIFIC AMERICAN. Mention should also be made of the Annex to Agriculture, which is to be erected by the American Commission, and which fully doubles the space originally allotted to the agricultural groups.

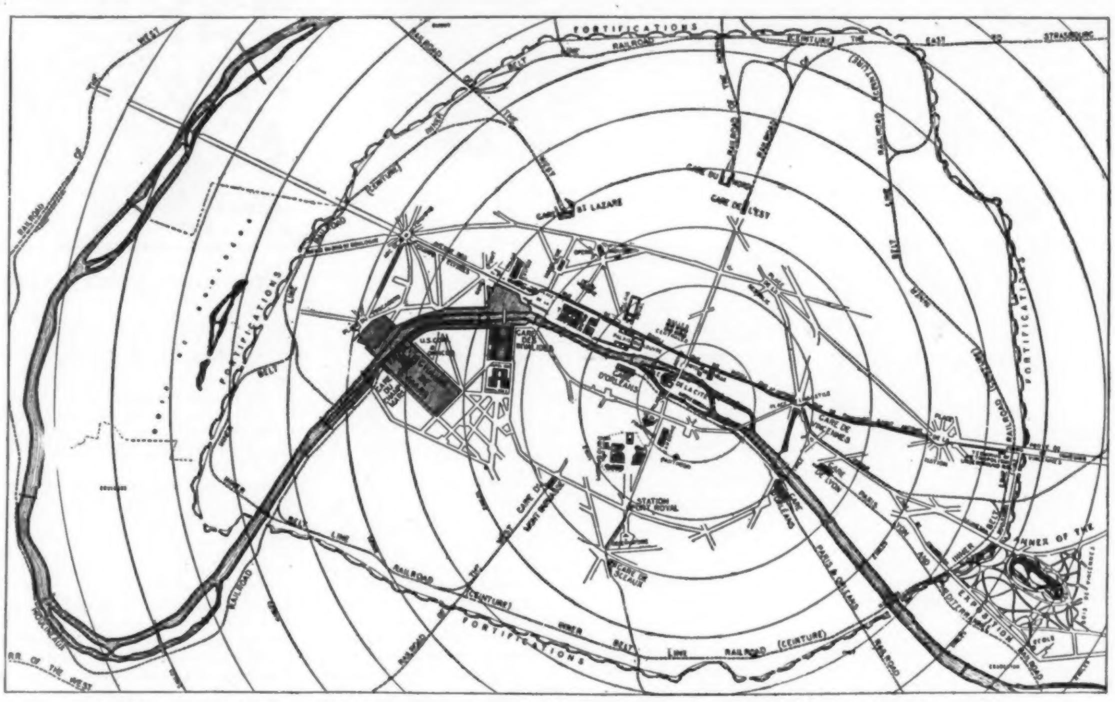
The old Palace of Machines which was used in 1889 is to be devoted to agriculture and food products, and will be known as the Palace of Agriculture. Nearly one-third of the central portion of the floor space of this structure, on Champ de Mars, is to be given up to the magnificent festival hall of the Exposition.

As previously remarked, the principal entrance, which is located very near the Place de la Concorde, and close to the Seine, will be in the form of a triumphal arch, upon the face of which will be emblazoned the arms of the city of Paris, while it will be surmounted by a colossal statue of Liberty. It is claimed that it will be possible to admit 60,000 persons per hour without difficulty.

It is the Palace of Electricity to which all eyes will naturally turn at night, and as its main façade reaches across the entire width of the open plaza in the center of the Champ de Mars, splendid opportunity will be afforded for the attractive treatment of the architectural features of the exterior of this palace.

Just across Avenue de Suffren from the Palace of Agriculture, there will be a mammoth wheel, some 25 feet higher than the famous Ferris wheel of Chicago, but built on a somewhat different principle.

There is no question but what the 1900 Exposition will be superior in its artistic decorations to any previous exposition, and stand as a monument of the remarkable skill and genius of the French nation in that direction.



PLAN OF PARIS AND ITS ENVIRONS, SHOWING THE RAILWAY CONNECTIONS.

THE AUTOMOBILE CLUB OF FRANCE.

By FRANCIS P. MANN.

THE history of this organization is intimately connected with that of the development of the automobile in France, which of late years has reached such an important point. The trials of speed which took place in 1894 from Paris to Rouen mark a period when the attention of the public was first attracted largely to this form of locomotion, and it was seen that the new vehicles, which were able to make without difficulty the long trip from Paris to Normandy, contained the germ of a revolution in means of transport, an amelioration of roads, and an increase in industrial, as well as social, interests. It was at that time that a nucleus of engineers, constructors and wealthy vehicle owners commenced to form a group which foresaw the great future which was in store for the new automobiles. When in 1895 the Count de Dion proposed a second demonstration of the value of the new method by a trial of speed from Paris to Bordeaux and back, a sum of 100,000 francs was raised within a few days, thus showing the enthusiasm caused by this subject. The success of these tests was great, and marked another important point in the history of the automobile. The public began to see that the new vehicle had come to stay, as was proved by the fact that in these tests an automobile could run without stopping for 48 hours, at a speed of 27 kilometers per hour. But it was necessary that there should be a united action among the promoters of the new system, that they should be brought into closer relations with each other, so as to act in common for the defense of their united interests against the regime of routine, which is always opposed to new enterprises.

It was the Count de Dion who first had the idea to found a club in which all these interests should be united, and which should carry on the work which had already awakened so much enthusiasm, and by means of which the makers and owners of automobiles could unite, become acquainted and discuss their common interests. In October, 1895, he discussed the matter with Baron de Zuylen and M. Paul Meyau, and the foundations of the new club were laid. The Paris journal Le Figaro took an active interest in the formation of the new society, and helped to make it public. It will be interesting to quote what it said on that occasion, as it indicates clearly the purpose of the club, to which it holds at the present time:

"The new Automobile Club is not only a club properly so called, as its title would seem to indicate, but rather an association for the encouragement and promotion of automobile affairs, whose headquarters will be fixed at Paris, with auxiliary societies and correspondents in the principal cities of France. At Paris will be located the building in which all the members may be united, and where also will be centralized all the documents and information relating to automobile matters, as well as the various technical committees, libraries, maps, etc., and where meetings of these different committees will be held, as well as of those whose duty it is to defend the cause of automobilism before the courts and legal powers. It will provide for the installation of special storage quarters in Paris and throughout the country, where its members will find all the resources desired; the club will remove all the inconveniences which are now encountered in this direction, and will have its engineers, mechanics, lawyers, etc. It will aid by its counsel and its support the municipalities desiring to establish services for the transportation of passengers or merchandise, and will endeavor to bring before the eyes of the public, through the agency of the press, the progress realized from time to time; it will organize expositions, competitive tests, races, etc."

The activity of the persons interested, aided by the influence of the Figaro, the Locomotion Automobile and other journals, soon put the club upon its feet. On November 12, 1895, the first formal meeting was held at the residence of the Count de Dion, consisting of twenty-five of the leading spirits, such as M. Marcel Deprez, Georges Berger, Baron de Zuylen, Clement, Dufayel, Jeantaud, Count de la Valette, de Lucenski and others. MM. Marcel Deprez and Berger were named honorary presidents, and the statutes were read and decided upon. The Council of Administration was constituted, with Baron von Zuylen as president, and Count de Dion and M. Menier as vice-presidents. The Count de la Valette represented the technical section. A commission was named to select suitable quarters, and these were found at No. 4 Place de l'Opera, consisting of a series of rooms, including a library, dining room, secretary's office, etc.

At the end of two years these quarters became insufficient, and the Hotel du Plessis-Bellière, on the Place de la Concorde, was purchased by a stock company, formed by several of the wealthy members, for 1,500,000 francs. This building is situated in the central part of the city, and is near the Champs Elysées and the boulevards. As the building was an old one, it needed to be modified in the interior to suit the purposes of the club, and the work was given in charge of M. Rivier, the architect of the club and one of the influential members. The interior, as transformed, presents a handsome appearance, and one appropriate for the important position which the club now occupies. The building has five stories. The ground floor may be entered with vehicles by the porte-cochère, and in the rear are arranged suitable places for their storage, with special mechanics and inspectors to look after them and make repairs when necessary. On the ground floor are also the cloak rooms, waiting and toilet rooms. Two large staircases lead up to the second floor, in which are a vestibule, parlors, dining rooms, bath rooms, and large galleries which may be used for exhibitions. The third story contains the reception rooms and those used for fêtes, banquets, congresses, or general assemblies. On the fourth story are the rooms of the committee, offices, library, etc., and on the fifth the billiard rooms, dining rooms, kitchens, etc. Above extends the terrace garden, with fountains and banks of plants and flowers. From this point one has a splendid view of the city, with the Chamber of Deputies on the opposite bank of the Seine, and the buildings of the Exposition, which are now slowly rising in preparation for next year.

In order to separate the technical part of the work from the social, a separate organization has been formed, most of whose members are also members of the club; this is called the Société d'Encouragement. This branch of the club has taken an active part in pushing all automobile affairs, and has organized exhibitions, competition tests, etc. The first annual exposition of automobiles was held last year in the month of August, and was an important event, serving to bring before the public the progress already made. All the leading types of electromobiles, such as Jeantaud, Krieger, Jenatzy, etc., were represented. About the same time a series of competition tests of automobiles was undertaken, in order to show in a practical way the capabilities of the new vehicles. They were made to run over a distance of 60 kilometers each day, for ten consecutive days; the routes were laid out in the streets of Paris or in the suburbs. Some of the streets have very steep grades, especially in the quarter of Montmartre, where also the paving is an exception to the general good quality to be found in Paris. A technical committee was appointed by the club, under the direction of M. Forestier, to regulate the tests, examine the vehicles and make the final report. Each vehicle was accompanied by an expert, who made the necessary observations, and in the case of the electromobiles took readings of the instruments to determine the energy consumed. In order to test the value of the electric and mechanical brakes the vehicles were made to run down a steep grade at full speed, and at the moment when the signal flag was lowered the brakes were put on, and the time necessary to come to a full stop was taken with a stop-watch; it was found that most of the vehicles could be stopped within a space of five to eight meters. The committee took all these notes, and after the tests were finished made out an official report in the name of the Automobile Club, which was presented to the Civil Engineers' Society of France. This year a similar series of tests has been made, and the vehicles make a better showing than last year's results. A greater number of electromobiles was entered this year and, in fact, took the prominent place in the tests; it was found that the electromobiles, as well as the accumulators, have been greatly improved since last year. Most of them made the run of 60 kilometers in less than four hours, giving an average speed of 15 kilometers per hour.

Shortly afterward the second annual exposition of automobiles was held, under the supervision of M. Rives. Two immense tents were erected for the purpose in the Gardens of the Tuileries, in the central part of the city. The exposition, by the number and variety of its exhibits, gave a striking example of the progress which has been made since last year, and shows the important place held by France in the automobile industry. Among the electromobiles the number of manufacturers is increasing, many of them saying they are receiving more orders than they can fill. The principal makes are those of Jeantaud, Krieger, Jenatzy, Mildé, Patin, etc. The American vehicles attracted favorable comment at the exhibition; there were represented the Columbia, Riker, and Sperry types. Apropos of the exposition it will be interesting to quote the words of Baron de Zuylen at the annual banquet of the club recently held. After congratulating the club and members of the committee for the part they have had in the success of the exposition, which has so brilliantly marked the progress of the automobile industry, he gives some figures which show the progress made. Last year there were about 270 exhibitors, with a space of 4,880 square meters; this

year there were 340, and the space occupied reached 10,000 square meters. He speaks of the astonishing progress of the automobile industry, with which the club has always been closely identified. Eight or nine years ago France possessed less than a dozen constructors; now there are at least 600 constructors who have already produced 3,250 automobiles of all kinds, not counting the motocycles (tricycles operated by gasoline motors), which reach the ten-thousands. These results are encouraging when it is considered what an important part the club has taken in forwarding the movement. The progress made in the construction of the vehicles is very great. At the time of the famous Paris-Bordeaux trip in 1895, M. Levassor made the distance of 1,160 kilometers in forty-eight hours, and this was considered an astonishing performance. This year, in the tests of May 21, the same distance was covered in less than eleven hours. Two years ago, in the Nice-Turbie tests, the first arrivals made the steep ascent of 17 kilometers in one hour; this year fourteen vehicles accomplished the same result in half the time. He states that some of the principal constructors have orders for automobiles which are two or three times as large as those for horse vehicles.

The club is now carrying out a series of competitive tests of accumulators, in order to determine which of the leading types is the best adapted for automobile work. M. Jenatzy has designed what he calls a "trepidateur" or "shaker;" it consists of a stationary four-wheeled wagon truck, rubber-tired, which is caused to jump up and down by a mechanism worked by an electric motor, thus imitating the jar which the vehicle would experience on the road. The wagon body is replaced by a platform, upon which the accumulators are placed, each in its appropriate box. They are charged in series, after which they are discharged through a lamp-load, which is made to vary in each half-hour from 10 to 100 amperes by a revolving commutator. At stated periods the voltage of each battery is measured, and if it fails to reach the required figure after four such measurements, it is excluded from the tests. Owing to the authority of the club, a number of makers from different parts of Europe have sent their batteries to be tested, and side by side on the platform may be seen French, English, German, Austrian and Italian makes. The club expects to award diplomas or medals to the successful competitors.

Among the interesting events of this year may be mentioned the Tour de France, in which a distance of 2,300 kilometers was to be covered in eight stages. The members of the club were largely represented among the 49 competitors. Of these, 19 were able to finish the distance.

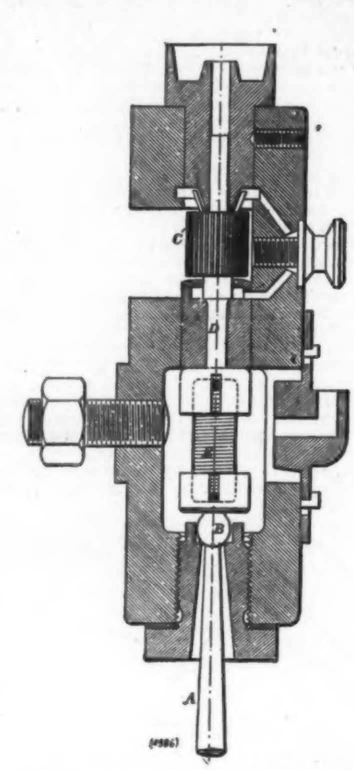
An important work is carried out by the legal committee, who act in concert with the minister of public works for the establishment of road regulations for the circulation of vehicles in the city and upon the roads. In his valuable work, the "Handbook of the Automobilist" (Carnet de Chauffeur), the Count de la Valette gives a résumé of the rules which have been lately established, including measures of surety, permits and authorizations for conductors of automobiles, conduct and circulation of vehicles, etc.

The club has taken active measures to establish a series of charging stations throughout the country, and to draw up a map upon which the stations will be located. This information will be particularly valuable to conductors of electromobiles who wish to make a trip of any considerable length. A series of signals has also been erected along the principal roads, indicating the commencement of steep grades or bad places, etc., so that, when going at full speed, accidents are not likely to occur. A series of sign cards has been distributed by the club among the different repair shops, hotels, etc., along the routes, in order to indicate to the members the best places for storage, repairs, hotel accommodations, photographic dark rooms, etc.

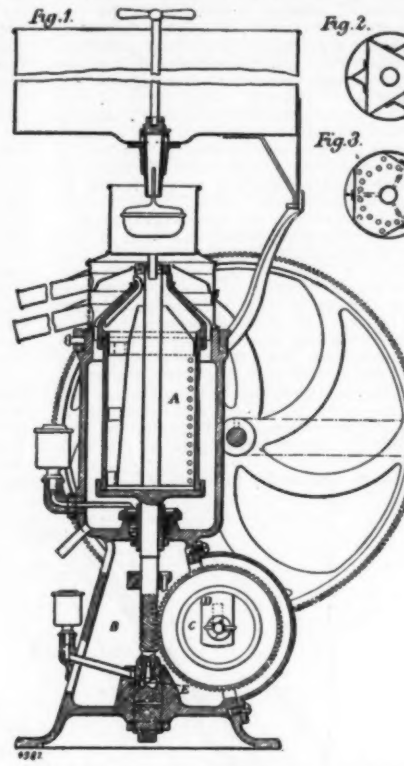
In the future, when a grave accident of any kind has been caused by an automobile, the club will send an expert on the ground at once, who will inspect the ground and the vehicle, take testimony, and inquire into the facts of the case; he will then make out a report for each case, in which the real responsibility for the accident will be determined as nearly as possible. This will be of great service to the members in cases where an accident is followed by legal proceedings, and will insure their protection.

The club has also commenced the work of standardizing certain parts of automobiles, in order that they may be easily and quickly replaced when making an extended tour. A committee has been appointed to standardize, as nearly as possible, the transmission chains by adopting a series of definite sizes, so that, when a chain is broken en route, it will not be difficult to find another and replace it.

Following the example of the Automobile Club, a number of similar organizations have been formed in the various cities of France and Europe. Among the former may be mentioned those of Bordeaux, Dijon, Nice, Lyons, etc., and among the latter the clubs of England, Austria, Switzerland, Italy and Belgium.—Electrical Review.



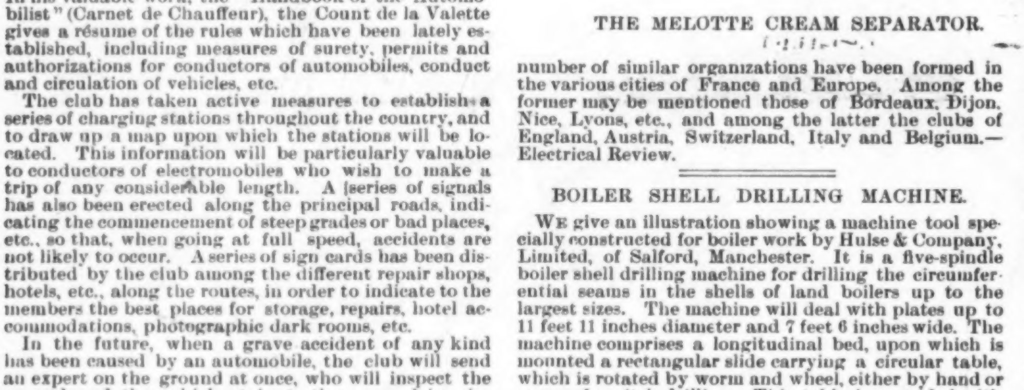
THE MELOTTE CREAM SEPARATOR.



THE CROWN CREAM SEPARATOR.

BOILER SHELL DRILLING MACHINE.

WE give an illustration showing a machine tool specially constructed for boiler work by Hulse & Company, Limited, of Salford, Manchester. It is a five-spindle boiler shell drilling machine for drilling the circumferential seams in the shells of land boilers up to the largest sizes. The machine will deal with plates up to 11 feet 11 inches diameter and 7 feet 6 inches wide. The machine comprises a longitudinal bed, upon which is mounted a rectangular slide carrying a circular table, which is rotated by worm and wheel, either by hand or power, for pitch drilling. This table is provided with five gripping jaws, which are operated simultaneously by bevel gearing, for gripping the bottom of the plate. The rectangular slide carries also a rigid abutment column which is fixed thereto, and round which the table is free to move. On this abutment column is mounted a gripping chuck adjustable vertically thereon to suit different widths of plates. The gripping apparatus consists of five sets of jaws adjustable simultaneously by large internal bevel wheel and pinions for gripping the top of the plate, each jaw being extended so as to form a support to the plate for resisting the pressure of the drills. This apparatus being free to move with the boiler shell round the rigid abutment column, the necessity of gripping and releasing after every few holes have been drilled is avoided, as the shell when once gripped need not be released until the drilling of the circumferential seam is completed. This has been proved to be a great advantage both as regards time and accuracy of pitch drilling. The two vertical standards carry a transverse slide bed, which is counterbalanced and adjustable either by hand or power for drilling various widths of plates. Mounted on the transverse slide bed are the five drilling headstocks fitted with steel spindles 2 inches diameter carried within non-rotating sliding sleeves, an arrangement which gives great steadiness to the spindles. Each drilling headstock carries an overhanging arm with a guide bush for supporting the outer ends of the drills and preventing them from breaking, and also a "center finder" for quickly setting the spindles to the center line of the boiler. The self-acting feed motion to the drill spindles may be applied to or suspended in connection with all the drills collectively or any number of them separately. A platform is usually provided for the attendant, from which he can control the entire working of the machine.—The Engineer.



DRILLING MACHINE FOR BOILER SHELLS.

NOVEL ENGLISH CREAM SEPARATORS.

THE Royal Agricultural Society offered prizes this year for two classes of cream separators, viz., those driven by power, suitable for farm use, and those driven by hand, and not requiring more than 2,500 foot-pounds per minute to operate them. To each class prizes of £20 and £10 were offered, and the trials occupied nearly a week. There were six entries in the power class, and the first prize was awarded to the Dairy Supply Company, Limited, of Museum Street, Bloomsbury, London. The second prize in this class was not awarded. In the hand machines the Dairy Supply Company took the first prize and the Melotte Separator Sales Company, of Counterslip, Bristol, the second prize.

The Melotte Company showed seven separators varying in capacity from 33 gallons to 85 gallons an hour, and it is claimed for them that they run exceedingly lightly, so that the largest can easily be turned by hand. The one which took the prize is of 45 gallons capacity and can be driven by a boy or girl. It differs from all other separators in that the bowl is hung to the lower end of a vertical spindle by a hook. This spindle has a universal joint at the top where it is driven, and it is really beautiful to see the bowl steady itself as the speed increases. At first the bowl and the spindle wobble badly, but as the rate of revolution increases, they move less and less, until suddenly the bowl becomes absolutely steady and it is scarcely possible to tell that it is rotating at all. In the inside of the bowl are a number of perforated zigzag plates made apparently by taking a number of concentric cylinders, bending them in and out into zigzag form, and perforating them with holes and slots. These plates divide the milk into thin layers and aid the separation by keeping the centrifugal and centripetal streams from breaking each other up and recombining the milk and cream. The bowl rotates within a cast iron casing, lined with porcelain enamel, and provided with two gutterways, one for each product. This casing, which

is in halves, hinged together, can be opened wide to allow the bowl to be lifted out for cleaning. The whole machine is an interesting piece of work, from the point of the mechanic, and evidently the judges thought well of it in the dairy. The method of driving and supporting the spindle is particularly worthy of notice, as will be understood from the accompanying section, in which *A* is the upper part of the spindle carrying the bowl at its lower end. It is supported on a globular bearing. The driving power is applied through the pinion, *C*, to the upper spindle, *D*, which runs in two bearings. The connection between the spindles, *D* and *A*, is made by the spring, *E*, which has pins fitting into slots in the enlarged ends of the two spindles. This connection makes an efficient driving medium, and yet allows the lower spindle perfect freedom.

A new separator, "The Crown," manufactured by the Svenska Centrifug, Stockholm, was shown by Messrs. Pond & Son, Limited, Blandford, Dorset. It is stated that this machine has been introduced to supply a very simple apparatus at a moderate cost. They are made of capacities varying from 6 to 66 gallons per hour. The bowl, *A*, as shown by the engraving annexed, is long and cylindrical, and is provided with an inner bowl named "the crown and center tube." It has thus only two inner parts. On the bowl spindle is cut a worm, *B*, which is driven by a worm wheel, *C*, connected to its shaft by a very ingenious friction pawl, *D*, which slips immediately the bowl overruns the driving handle. The footstep of the main spindle runs on two balls, *E*.—We are indebted to London Engineering for the engravings and description.

PROLONGATION OF THE ORLEANS LINE TO THE QUAI D'ORSAY.

IN 1862, the Orleans Railway Company spent eighteen million francs for the reconstructing of its Place Walhubert Station as we know it at present. It is probable that it would not have involved itself in such an expense had it been able to guess at future necessities, those which are the cause of the new installation at the Quai d'Orsay at the head of the line of the Orleans railway. The rapidity and convenience of the trains and the intelligent rearrangement of the time tables now permit of bringing to Paris a passenger living at a distance of 150 miles therefrom and of taking him back home on the same day after a stay of seven profitable hours in the capital, his meals having been taken in the dining room cars. On another hand, the suburbs are constantly growing and daily assuming a greater importance.

All such improvement and progress was losing half of its value through the remote situation of the old station from the center. The very favorable circumstance of the demolition of the Cour des Comptes, for the ground of which no use had been found, decided the company to enter into negotiations with the state for the acquisition of the site of the structure just mentioned as well as of that of a contiguous barracks that could be easily alienated. Finally, let us say that when the company became owner of the Sceaux line it prolonged its new track as far as to the Carrefour Medicis, and this facility given to the Parisians increased the traffic 40 per cent. of itself. This circumstance alone ought to have removed the last scruples of the company and to have caused it to expend the forty million francs necessary for the installation of its terminus upon the Quai d'Orsay.

The negotiations entered into with the state ended in December, 1897, and the company, whose projects were already matured, began work immediately, so that, if everything is finished for the Exposition, as it is hoped that it will be, it will have required but two and a half years to construct the two and a half miles of track in Paris. The material difficulties of the work may be calculated at a mean cost of twenty million francs per mile.

The present Walhubert Station comprises seven parallel tracks surrounded by buildings devoted to the different railway services. The company could not think of demolishing these without involving itself in a very heavy expense; and, on another hand, since the place had to be traversed through a tunnel, it was preferred to run the two tracks from the center down a slope of 1¼ inches to the foot so that they should pass under the buildings and reach the shores of the Seine after describing two curves of opposite direction.

The port St. Bernard is of exceptional width, and it has been possible to take a strip 29¼ feet wide from it without occasioning any inconvenience. The roadbed has been installed at the bottom of a sort of trench formed on the quai side of a sustaining wall to support the earth and roadway, and on the river side by a wall of millstone grit.

Beginning at about a hundred yards above the Pont Sully, the direction line (Fig. 7) becomes subterranean and continues to be so for all the rest of its extent. The tunnel was constructed by the new processes that have already given so great satisfaction both in the construction of the new collecting sewer of Clichy and of the Metropolitan railway. The work is carried on entirely beneath the surface, at which there is nothing visible. The earth is sustained by a huge shield in measure as the work proceeds at the heading, and the concrete or millstone grit masonry is immediately laid. The shield is pushed forward by means of hydraulic jacks, as usual. The work was begun at two points, that is to say, two shields were made to advance toward each other, one starting from the Sully bridge and the other from the Quai d'Orsay. The two shields, however, were not designed to meet each other, since the median part, situated upon the Quais Saint Michel and Grands-Augustins, was executed externally by ordinary methods (Fig. 1). The slight width of these quais did not permit of the construction of an arched tunnel, and so a cutting was made and covered with an iron roof capable of supporting the roadway.

As may be seen upon certain parts of the line that are already finished (Fig. 2), apertures have been formed in the wall that separates the tracks from the river bank. The object of these is to provide a constant ventilation and to allow the light to enter.

The tracks are on a level with the ordinary surface of the water. Should the latter rise, there would necessarily be an invasion and inundation. But care has been taken to establish in the masonry a floor hav-

FIG. 1.—VIEW OF THE WORK UNDER WAY NEAR THE PONT SAINT MICHEL.

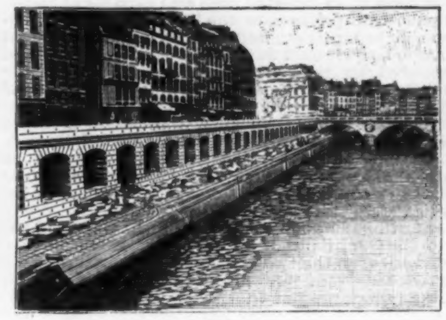


FIG. 2.—VIEW OF THE WORK UNDER WAY NEAR THE PONT NOTRE DAME.

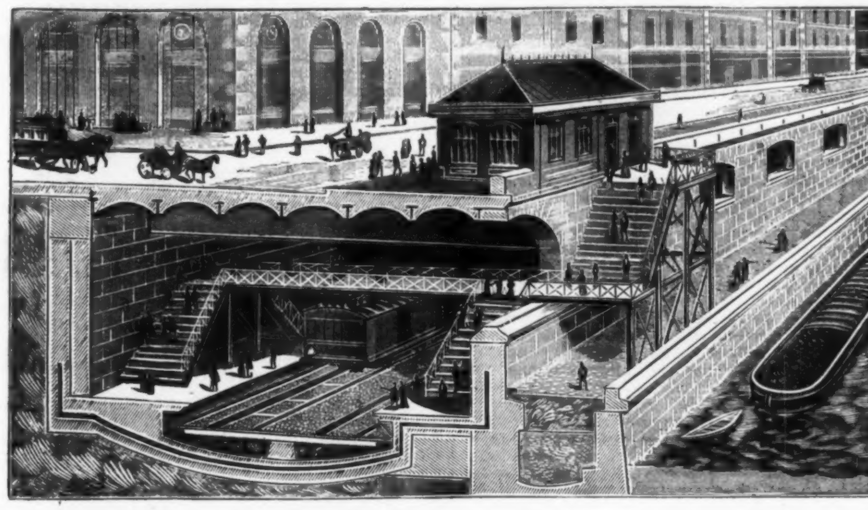


FIG. 3.—THE SAINT MICHEL STATION.

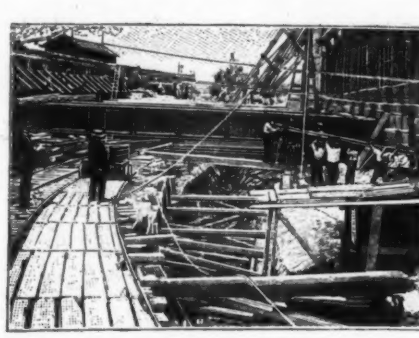


FIG. 4.—LAYING OF THE METALLIC FLOOR NEAR THE NEW STATION.

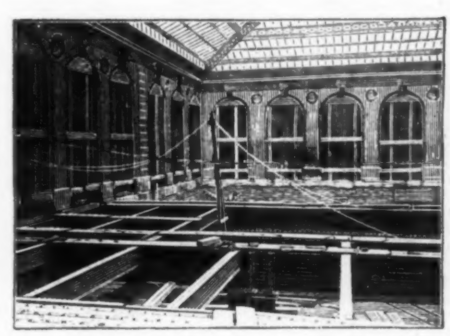


FIG. 5.—THE FLOORS UNDER THE CAISSE DES DEPOTS ET CONSIGNATIONS.

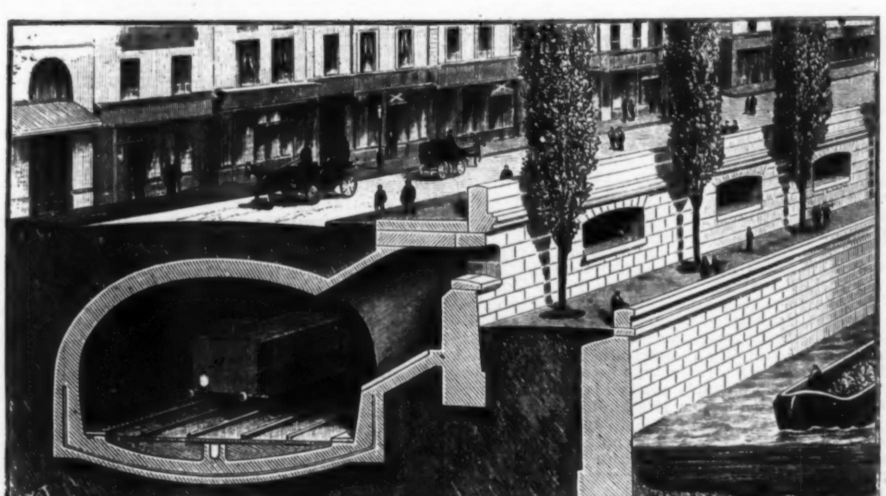


FIG. 6.—SECTION OF THE LINE AT THE POINT WHERE THE MASONRY VAULTS ARE CONSTRUCTED.

FIG. 7.—MAP OF THE NEW SECTION OF THE ORLEANS RAILWAY.

ing the form of an inverted arch and capable of resisting the upward pressure of the liquid (Fig. 6). If, despite such precautions, infiltrations of water should occur, the latter would flow into a central gutter and be removed by pumps. At the approaches to the Quai d'Orsay the vault is double, and the number of tracks is increased from two to four. This arrangement has been adopted in order to permit of a future junction with the Sceaux line, which, as well known, is to descend the Boulevard Saint-Michel and turn at a right angle upon the quais. Until such junction is made, the tracks located in tunnel No. 2 will serve for shunting, etc.

There will be but one way station upon the new line, that of the Quai Saint-Michel (Fig. 3). It will be constructed between the two bridges and be used only for the suburban trains and for passengers without baggage. As the object of the work in progress is to reduce the time of traversing Paris for travelers, it was impossible to cause long distance trains to stop at this intermediate station. The duration of the trip of the 2¼ miles under construction will be about seven minutes. The traction will be wholly electric, and the locomotives will collect the electro-motive force along the course of the route. There will therefore be no smoke nor any other agent to foul the air of the tunnels. The changing of locomotives is to be done at the Walhubert Station. It is anticipated that no loss of time is to be caused by the operation. In fact, all trains have to stop at the old station for the stage coach and mail service, and as such stoppage cannot be less than two minutes, ample time will be afforded for changing the engines.

The construction of the section along the Seine is going to cause a revolution in the eastern suburbs. The latter, despite their attractions, had been completely abandoned by Parisians on account of the difficulty of reaching the Orleans Station. But things are about to change, and the land of this district is now greatly enhancing in value.

Later on, the Orleans line will be connected with that of the West by a section passing in front of the Chamber of Deputies and uniting the Quai d'Orsay with the Invalides; thus the population of the east of Paris will on its side be able to distribute itself in the suburbs of the west, which are now nearly unknown to it.

As may be seen, the construction of the new section will be the principal cause of a great movement of the population either in one direction or the other.

For the above particulars and the illustrations, we are indebted to La Nature.

CHRISTOPHER COLUMBUS AND THE MEDICAL PROFESSION.

IT is stated in Italia Termale that Dr. A. M. Fernandez de Ybarra has published an interesting work on the medical history of the expeditions which Christopher Columbus undertook in his search for a new world. During the great discoverer's first voyage, his slender following, which all told numbered but 120 souls, included two physicians, to wit, Master Alonzo, on board the caravel "Santa Maria," and Master Juan, on board the "Pinta." When Columbus returned to Spain, the last-named officer remained behind at Fort Navidad, and made one of the thirty-eight victims who were massacred by the natives of San Domingo. The principal medical officer of the second expedition, which consisted of 1,500 men, and sailed from Cadiz in the month of September, 1493, was Dr. Diego Alvarez Chanca, of Seville, physician in ordinary to the King and Queen of Spain. In a report addressed to Ferdinand, Columbus referred to this officer in the following flattering terms: "I make a point of directing the attention of your Highness to the never-ending work wherewith Dr. Chanca is overwhelmed in consequence of the heavy sick roll, together with the dearth of provisions; but in spite of all difficulties he evinces the utmost zeal in everything that concerns his art. Your Highness having left me free to fix the amount of his remuneration (although it is perfectly certain that neither I nor anyone else in my position could give him a sum even approaching what he would gain on land), I have opened for him an annual credit of 50,000 maravedis" (about £144 sterling). Dr. Chanca is given the credit of having cured Columbus of a malignant fever which had brought him to death's door, and he is also said to have been the first person to write a description of the New World, his contribution taking the form of a report to the Municipal Council of Seville. On his return to Spain he produced his "Commentum Novum in Parabolis Divi Arnoldi de Villanova," which was published at Seville in 1514. But it was not solely to the members of the medical profession who sailed in his company that Columbus expressed his indebtedness. Paolo dal Pozzo Toscanelli, a famous physician and astrologer of Florence, gave him what is described as excellent advice regarding the possibility of reaching India from the west, and in order to simplify matters likewise presented him with a map showing the course he ought to steer. The value of the Florentine's counsel is open to question, but there was another less pretentious practitioner who undoubtedly was able to render the hero an inestimable service at a turning point in his career. Discouraged by persistent opposition and well-nigh broken-spirited, Columbus had sought asylum in the convent of Santa Maria della Robida, in Andalusia, whereupon the prior, believing him to be mad, sent for Dr. Garcia Fernandez, an unassuming country surgeon from the neighboring hamlet of Palos do Moguer. Happily the village Galen was a man of discernment. He quickly perceived that his patient was no lunatic but a man of genius, and instead of consigning him to chains and a dungeon after the fashion of the day, he not only restored him to health by his treatment, but also won for him the good will of the prior, who furnished him with means and introduced him at court. It is generally stated that Columbus died from gout, but Dr. de Ybarra disagrees with the authorities who are responsible for this diagnosis. In his opinion death was due to cardiac complications consequent on chronic rheumatism, and in support of this contention he adduces the testimony of several persons who aver that they saw the dying navigator during the last month of his life and that his body was enormously swollen from the chest downward.—Lancet.

MISCELLANEOUS NOTES.

Queen Victoria has seventy-one direct descendants. The queen has seven sons and daughters living, thirty-three grandchildren, and thirty-one great-grandchildren, making a total of seventy-one. The ages of the royal family in the direct line of succession are as follows: Prince of Wales, fifty-five years; Duke of York, thirty-four years; Prince Edward, of York, five years.

The use of solutions of certain metallic salts for the purification of acetylene so as to remove phosphureted hydrogen, the most obnoxious impurity, requires the presence of an acid to prevent the formation of explosive acetylides. The addition of an alkaline chloride, more particularly ammonium chloride, has been found by C. Göttin to materially increase the effective power of the purifying solution, while the presence of an acid is unnecessary.—Berichte, 32, 1879.

The Germans are about to establish a record with one of their coast defense ironclads by lengthening her some 23 feet. The vessel, the "Hagen," is at present only 239 feet 6 inches, and 49 feet 2 inches beam, displacing 3,495 tons on a mean draught of 17 feet 9 inches. She was built at Kiel in 1893, and is one of eight similar vessels, though the two latest of the class, the "Odin" and "Ægir," have a length of 255 feet and a beam of 51 feet, the two latter being a knot faster, though engined with only 200 horse power more than the others. The "Hagen" and five of her sisters have complete armor belts 7 feet 6 inches deep, and varying from 6 inches to 9·4 inches in thickness.

A natural curiosity consisting of a mountain of alum is described in Le Tour du Monde. It is found in China, 12½ miles from the village of Lion-Chik, and bears the name of Fan-Chan Mountain. It has a diameter of not less than 10 miles at its base, and a height of 1,940 feet. For centuries the inhabitants of the country have exploited this natural source of wealth, digging from it yearly hundreds of tons of alum. To obtain it they quarry blocks of stone, which they first heat in great furnaces and then in vats filled with boiling water. The alum crystallizes out and forms a layer 6 inches thick. The compact layer thus produced is afterward cut into blocks weighing 10 pounds.

Switzerland is fast taking an important place as a manufacturer and exporter of machinery. Its exports of machinery during last year amounted to 4,250,000 francs in excess of those for the previous year, while the imports show a gain of 5,250,000 francs for the same period, the imports and exports during each year amounting to about 38,500,000 francs. It is noteworthy that, whereas Switzerland has until recently bought all locomotives used in the country from abroad, during 1898 there were 32 such engines exported from the country, while only 6 were imported. Notwithstanding the great progress which has been made in the native manufacturing industries during recent years, Switzerland in 1898 imported 1,271 carriages and wagons, chiefly of German make, and representing a value of 2,500,000 francs.

A recent steam pumping plant erected in Germany is at the Piesberg coal mine near Osnabruck, says The Engineering and Mining Journal. This has two tandem compound condensing engines placed back to back in an engine room 128 feet long and 13 feet broad, together lifting 12 cubic meters when making 60 revolutions per minute. The pumps are 275 mm. diameter and 900 mm. stroke; the lift is 180 meters. On trial these engines developed 303·9 indicated horse power for 264·2 effective horse power in water delivered, including friction in the pipes, with a consumption of steam, at 6·8 atmospheres effective pressure, of 7·92 kilogrammes per indicated or 9·11 kilogrammes per effective horse power per hour. A very large underground engine now in course of construction, intended to lift 30 cubic meters per minute about 400 feet, is of the triple expansion form, arranged as a double tandem, with two low-pressure cylinders, and is expected to work with only 7 kilogrammes to 7½ kilogrammes of steam per effective horse power per hour.

In a recent issue of the Journal für Gasbeleuchtung, Mr. C. Killing discusses the preparation of automatic igniters for coal gas. A mass of spongy platinum is unable to do this, although it will get hot if exposed to a stream of this gas. If, however, a pellet of spongy platinum is connected to a fine platinum wire, the ignition may be effected, as the wire under these conditions becomes heated to a sufficient degree. Spongy platinum, if exposed much to the heat of the flame, soon loses its porous character, and to avoid this the plan has been adopted of using pellets of asbestos, or meerschaum dipped into chloride of platinum, and the metal finally reduced. These pellets are supported by platinum wires, which effect the actual ignition. Another plan which is stated to have proved successful consists in dipping a cotton fabric, through which fine platinum wire has been woven, into a mixture of thorium nitrate and chloride of platinum. On burning off the cotton, the platinum wire remains intertwined with a mixture of thoria and platinum black.

The following instance of loss of hair due to mental shock is related by M. Boissier in Le Progrès Médical, June 17. He says, as translated by The Lancet: "The subject was a vigorous peasant, aged thirty-eight years, who was not of a nervous temperament beyond being slightly emotional. His hair was abundant and of a dark chestnut color and not even slightly interspersed with white filaments. One evening, as he was returning home, preceded by his mule, on which was mounted his son, aged eight years, the animal slipped and the child was thrown off and trampled on several times. He was only severely bruised, but the father thought he was killed, and in endeavoring to save him was terror stricken. He trembled and had palpitations and a feeling of cold and tension in the face and head. On the following day the hairs of the head, beard, and eyebrows commenced to fall in quantities, so that after eight days he was absolutely bald. At the same time the skin of the face and head became paler. Without delay the hairs began to grow again in the form of a colorless down. Soon all the affected regions were covered with finer, more silky, and a little more thinly sown, completely white hair. The hair of other regions was not affected."

SELECTED FORMULÆ.

To Fasten Hard Rubber to Metal.—Good, previously soaked Cologne glue is boiled down until semi-liquid, and enough wood ashes stirred in till a homogeneous, moderately thick mass results, which should be warmed. Thorough fitting together of the pieces during the drying is advisable.—Neueste Erfindungen und Erfahrungen.

Acid Free Shoe Blacking.—1. Dissolve 150 parts of wax and 15 of tallow in a boiling mixture of 200 parts linseed oil, 20 of litharge and 100 of molasses. Heat to 230° to 248° F., with an addition of 100 parts of lampblack. When cold dilute with 200 parts of linseed oil and mix with a solution of 5 parts of gum lac and 2 of aniline violet in 25 of alcohol.

2. Powdered nutgall	50 grammes.
Rasped logwood	30 "
Water	200 "
Ferrous sulphate	30 "
Sirup	200 "
Shellac	10 "
Alcohol	200 "

Boil together for two hours the nutgall, logwood and water; strain while hot, add the sirup and iron; boil the liquid until it begins to thicken, then add the shellac dissolved in the alcohol.

WATERPROOF BOOT POLISH.

3. Beeswax	18 parts.
Spermaceti	6 "
Oil turpentine	66 "
Asphalt varnish	5 "
Powdered borax	1 "
Lampblack	5 "
Prussian blue	2 "
Nitrobenzol	1 "

Melt the wax, add the powdered borax, and stir till a kind of jelly has formed. In another pan melt the spermaceti, add the asphalt varnish, previously mixed with oil of turpentine, stir well, and add to the wax. Lastly add the color, previously rubbed smooth, with a little of the mass. Perfume with nitrobenzol and pour into boxes. Apply in small quantities with a cloth and brush. Use only once a week.

FRENCH PASTE FOR PATENT LEATHER.

4. Add to some pure wax which has been melted on a water bath some olive oil, and then some lard. Mix thoroughly by stirring over a fire. Add some oil of turpentine, then a little oil of lavender. This will form a paste which should be put in boxes. Apply with a linen rag. The paste keeps the leather soft and restores the gloss.—Pharmaceutical Era.

Blue Prints.—The following formulas from a recent issue of Photography produce ferro-prussiate paper, which is easily and inexpensively worked:

1. Potassium ferricyanide	2½ ounces.
Water	10 "
2. Ammonio-citrate of iron	2½ ounces.
Water	10 "

The two solutions are mixed immediately before use, and should not be exposed to daylight. A suitable paper (hard, smooth surface papers are best) is coated with the mixture by means of a sponge, care being taken to get the coating as even as possible, though a little streakiness is unimportant so long as no portion of the paper is uncovered. The paper is then dried in the dark, and printed under a negative in the ordinary way to bright daylight (sunlight if possible). The shadows should have a bronzed appearance. The print is fixed by washing in water, which may be used hot to facilitate the work. Should the whites refuse to clear, a trace of carbonate of soda will help to brighten them. A few drops of hydrochloric acid in the last washing water brightens the color. This paper requires a strong negative, and is slow in printing.

QUICK-PRINTING BLUE PAPER.

A.

Tartaric acid	1 ounce.
Water	2 "

B.

Ferric chloride	1 ounce.
Water	3 "

C.

Potassium ferricyanide	1 ounce.
Water	8 "

Take two drachms of A, and add ammonia drop by drop till the precipitate first formed redissolves. Then add slowly three drachms of B, stirring with a glass rod; then add eight drachms of C, also slowly. If B and C are added quickly, a precipitate will be formed, and the solution spoilt. The paper is coated in the same manner as in the first instance. A little arrowroot paste mixed with the solution will help to keep it on the surface of the paper and will give brighter prints. With this process the three solutions should be combined, and the paper coated and dried (by heat) under thirty minutes, as the solution rapidly decomposes.

Both of these processes give positives from negatives, blue lines on a white ground, and if a drawing is used to print from, white lines on a blue ground.

To obtain positives from positives, or from a drawing, blue on a white background, the formula is modified as follows:

A.

Gum	1 part.
Water	5 parts.

B.

Ammonio-citrate of iron	1 part.
Water	2 parts.

C.

Ferric chloride	1 part.
Water	2 parts.

Eight parts of B are added to thirty parts of A, and then five parts of C are stirred in, and the mixture is applied to the paper as before. This solution also rapidly spoils. After exposure the prints are developed with—

Potassium ferricyanide	50 grains.
Water	1 ounce.

Applied with a brush. So soon as the detail appears, the print is rapidly rinsed in water, and transferred to a bath of—

Hydrochloric acid	1 ounce.
Water	10 ounces.

To clear the whites.

TRADE SUGGESTIONS FROM UNITED STATES CONSULS.

American Agricultural Implements in New South Wales.—The successful introduction of American-made agricultural implements in New South Wales is comparatively recent, as the total importation of such articles into this country in 1897 was but £96,574 ($469,350), while during the year 1898 there was a total of £124,863 ($606,835) worth imported, says United States Consul George W. Bell, of Sydney. Until a few years ago, there was a real prejudice against the "flimsy," light, and unsubstantial "Yankee" implement. But a few enterprising agents "stayed" with the trade, and gradually it dawned upon the people that Americans were applying scientific principles in the construction of their implements and that they made no sacrifice of strength or durability by reducing the weight to the minimum.

Plows.—Fifteen years ago, I am informed, the greater portion of the furrow plows used in New South Wales were of colonial make, the imported ones coming almost exclusively from England. The American plow was considered too light for the heavy, compact soil so common in the colony. The frame of the old-style plow was made wholly of iron or steel and was about as long as the moral law. The moldboard was some 3 or 4 feet in length, with a turn that hardly turned the furrow. The introduction of the plow common to our farms, with the short beam and short and abrupt moldboard, was rather difficult and slow; but it finally won a place by coming into use with those whose farms were of light, friable soil.

While the single-furrow sulky plow is not often seen, more gang plows turning two, three, and often four furrows are used in proportion than in any part of our country with which I am acquainted. As the soil is usually stiff and compact, a plow turning a 14-inch furrow is rather uncommon. The usual plow cuts but 10 or 12 inches. The shares on plows for Australia must be of the best material.

I am inclined to think that now fully half the foreign made plows in use in the colony are of American make.

Cultivators.—I have seen none of what we call corn cultivators, either riding or walking, though there are many spring-toothed cultivators that answer well for cultivator and harrow work. These serve to pulverize the ground; and as most small grain is sown with drills, the spring toothed implement is generally in use.

Drills.—Grain and fertilizer drills are recent importations. For a new country, there is a considerable use of fertilizers in this colony, and wherever these are used for wheat fields the drill has found a place, as it is the most economic implement for the double purpose of saving the grain and distributing the fertilizer. Most of these now come from the United States. The wheel pulverizers, or rolling cutters, may also come under this head, and of the many in use the United States furnishes a goodly portion.

Harvesters.—The United States has a fair share of the harvester trade, not only in New South Wales, but in all the Australian colonies. American reapers and binders are not only very attractive in appearance, but they are light to handle, of light draft, strong, durable, and rarely out of order. I am almost convinced that nine-tenths of the reapers and binders sold in Australia are of American make. Our manufacturers have satisfied the requirements of this market, and they are now reaping their reward.

Mowers.—We have a good trade in mowers in New South Wales, but in this machine we are not far ahead of the English make, and not much ahead, if any, in our sales in this market.

Steam Engines.—American engines, stationary, portable, and traction, have failed to win the favor I think they deserve. While those used generally give good satisfaction, they are looked upon as too light and not durable. We should have better success in this line.

Chaff Cutters.—Here, as a rule, people do not feed hay as we do, but nearly all coarse provender is cut with a machine made for the purpose and is fed in a form called "chaff." In the market or among horse drivers and owners one seldom hears the word "hay;" "chaff" is the common expression. Some of the chaff cutters are large machines that are taken from farm to farm, as our thrashers are, when the hay, either loose or bound in sheaves, is cut by the ton. These chaff cutters are almost all of English or colonial make. We have no share in this trade. The power, called by us horse power, used in running these chaff cutters, as well as those used for shellers, wood sawers, shearers, and the like, are almost all of English make. The American horse power has not quite satisfied the people in the matter of strength.

Harrows.—In these implements, we lead in New South Wales markets. The people here use excellent machinery, and none but the best will suit them; so the steel frame joint harrow and the disk harrow or pulverizer are required. The frame must be light, strong, and easily handled.

Thrashing Machines.—The American thrasher is not in favor in Australia. I do not know why, as I believe it to be superior to all others; but for some reason the people do not like it. In Australia, the straw of wheat is lighter for the yield of grain, and cleaner from all weeds and trash, than in any country I ever saw, possibly excepting Normandy, in France. It seems to me that our thrashers are especially adapted to the conditions here, but the farmers do not buy them.

Corn Planters.—The area planted in corn in New South Wales is not great, and there are few farmers who raise much of this cereal. Last year there were but 209,586 acres in the colony. The corn planter is used, but generally it is a "hand planter" or a single-row machine. The double row, two or four horse check-row planter is hardly known by the farmers, and as it is not yet needed, it will be some time before it will be common in the market.

Corn Shellers.—With the small acreage of corn grown, the corn sheller is, of course, not in very extensive use. Our country furnishes most of the shellers for this market. A great majority are of the small, single-hole type. There are also several with two holes, and a few, very few, large ones, run by steam power.

Wagons and Buggies.—What we call a "wagon," especially the four-wheeled vehicle which we call a "farm wagon," is unknown in Australia. There are buses, stages, and some carriages, and a very few transit wagons, but nothing like the American wagon is seen. Here the cart is omnipresent. Articles from 20 to 40 feet long, telegraph and telephone poles, long pieces of structural steel, and the like, are balanced on a cart hauled by one, two, or three horses, tandem. We have a fairly good carriage and buggy trade, but it should be increased, and could be were freights reduced.

Wine, Cider, and Other Presses.—These are being made in the colonies to some extent, but the American presses seem to be the most popular, and will probably hold the market. As all the hay here is pressed, we should have a good trade in hay-pressing machines, and, in fact, our trade in this line is growing.

Feed Mills.—As a considerable amount of the maize fed to any kind of stock is ground or crushed, there is considerable demand for these machines; but as a rule, the American machine is considered rather light, and liable to break or get out of order. The United Kingdom furnishes most of these implements.

Winnowers, or Grain Cleaners.—The United States articles so far have failed to satisfy the requirements of the trade.

Hayrakes.—In hayrakes, we about divide the market with England. I have not seen our best rakes in this market. The rakes for New South Wales should be very strong and the teeth must be numerous and of excellent quality. I think there is little use for hay tedders in this colony, as the weather is usually very dry at the season of hay harvest. Much of the hay is also made of wheat, cut and bound in sheaves by a harvester.

Pumps.—There are many American pumps, both windmill and hand, used in this country. However, as most of the people in this and the adjoining colonies are supplied with water from tanks set some feet above ground and fed by occasional rains on the roof of the buildings, there can be but a limited trade in this line.

Miscellaneous.—In lawn mowers, seed planters, and garden machinery, we have a fairly good trade; while in pitchforks, hoes, rakes, shovels, and the like, we have little reason to complain.

Motor Vehicles in Shanghai.—In reply to inquiries from a Chicago firm, Consul-General Goodnow writes from Shanghai, July 10, 1899:

I would advise that catalogues and dealers' net prices be sent to the following American firms in Shanghai: American Trading Company, Mustard & Company, Dunning & Company, China and Japan Trading Compony, Fearon, Daniel & Company, Wisner & Company, Frazar & Company, and A. W. Danforth. It will probably be found feasible, after correspondence, to make one of these firms an exclusive agent.

This is an ideal place for motor vehicles. The town, built on alluvial deposit in the mouth of the Yangtze River, is level. The roads are macadamized, and the climate is such, especially in the summer, that everybody drives. The horses are small, about the size of and character of our Indian ponies. The foreigners are comparatively few (say 5,000 men, women, and children); but there are nearly 500,000 Chinese in the settlements, and these take very kindly to our mechanical inventions as soon as they see them. Shanghai, also, is the distributing point for central and northern China. The merchants from the other treaty ports come here to buy their goods. Arrangements should be made to show vehicles, and to make a practical everyday demonstration of their ease of management and durability.

The Chinese will not buy goods without having seen them. The average Chinese has seen so few new things that it is not easy for him to exert his imagination. Foreigners here are also slow to buy motor vehicles. The prices are considered high, and many think of the vehicles as experimental playthings. Neither the foreigners nor the Chinese can be induced to buy by descriptions or catalogues. There have been one or two automotors shown here, but they were of an inferior type and manifestly unfit for either use or pleasure.

This is the best time to push this trade in Shanghai, as there are no street railways here and the city is growing so rapidly that need is felt for more rapid transit.

There are two ways to advertise these new vehicles. One is to send a machine to some person well known here, who will use it constantly, demonstrating the fact that it can be used by an amateur for pleasure at a cheap running cost. I am inclined to think myself that this would be the better plan. It must be remembered that the cost of transportation in Shanghai differs from that in Chicago. Here, a carriage with two horses, driver, and footman can be hired for $75 Mexican (say $36 gold) per month. Or if one owns ponies they can be fed for $6 Mexican each per month, and the driver and footman can be hired for $17 Mexican (for the two) per month. It would be necessary, under this plan, to practically give the use of a vehicle to some well known person who would use the same constantly and keep it in repair. It may be possible that a like result would be reached by placing the vehicles on exhibition with one of the above-named firms; but if it is desired to get a part of the Chinese trade—which is immense and is thoroughly interested in American mechanical inventions—I would strongly urge that one or more machines be shown on the streets here, in such a manner that the Chinese will know that they are used by Americans of a position that will guarantee their desirability as vehicles of use, pleasure, and fashion.

Samples of United States Goods Wanted in Syria.—Of late, considerable interest in American manufactures of various kinds has become manifest among Beirut merchants, says U. S. Consul G. Bie Ravndal, of Beirut. This may be due to the fact that German export houses are drawing the lines tighter on Syrian commission merchants; or it may be attributed to the late war, which brought the United States into prominence even here in the Levant, where it was formerly known only vaguely and where nobody was aware of its industrial and commercial achievements. Articles commenting on our tremendous exports have been translated from French or, through the co-operation of the consulate, from American papers and published in the local Arabic sheets. In this connection, it should be remembered that while previously United States vessels laden with petroleum, furniture, hardware, cotton goods, cordage, lumber and flour have visited this port, no United States ship has been seen in these waters since 1880, excepting men-of-war and pleasure yachts. This new interest in American affairs has also been aided by the growing Syrian exports to the United States, the emigration, the agitation for direct steamship facilities, etc. The present time seems favorable for a move on the part of American manufacturers to meet this sentiment and take advantage of it.

The merchants here want samples, and will not, except in rare cases, buy from catalogues. Samples should cover, I should say, as far as practicable, flour, iron, petroleum, lumber, mechanics' tools, kitchen utensils, carriage springs, hardware in general (nails, screws, locks, etc.), pumps, windmills and hydraulic rams for irrigation, lamps, clocks, furniture (chairs, desks, and iron bedsteads), cotton goods (cheap and showy prints and heavy cloth for tents, awnings, sails, and shoes), canned provisions and prepared cereals, patent medicines, paints, leather and saddlery, paper (print, packing, and stationery), shoes and slippers, crockery, bicycles, toys, and notions.

I would recommend that such samples be sent—the sooner the better—to Mr. Fried. Wehner, an old trading and banking house in Beirut, which enjoys an excellent commercial reputation, and the financial standing of which, according to the Imperial Ottoman Bank (Beirut), is very high. I have before me a written pledge, dated May 12, 1899, and addressed to me, in which Mr. Wehner (whose affairs are now being conducted by Mr. Hummel, the honorary consul-general of the Netherlands in Syria) says:

"I declare myself to be ready to accept the deposit of the samples which American mercantile associations may be disposed to intrust to me, and to do my utmost in order to procure the best business transactions, not only at Beirut, but also for all the markets existing in Syria and Palestine. The experience I acquired during thirty years' work in this country allows me to guarantee full success on condition that the prices allow competition with European houses. Being also ready to furnish any information, I have the honor, etc."

If American manufacturers adopt the suggestions herein contained to the extent anticipated, a separate sample room will be set apart by Mr. Wehner for our goods. No charge will be made, as the house expects to make a profit on future orders, besides buying, for their own account, American goods which prove to be popular. Manufacturers or exporters at home will, of course, pay the freight on the samples or the post office charges, as the case may be; also the duty, amounting to 8 per cent. ad valorem on a low valuation, except on samples of cloth, which are admitted free up to a weight of 5 kilogrammes (11 pounds). There will also be a slight charge for port dues, lighterage and porterage. Samples of value will in due time be sold for the benefit of the owner, at the best obtainable prices. An employe of the consulate will devote half of his time to the promotion of the trade which such an agency will presumably help to create, and the consulate will, of course, continue to give the matter of introducing American goods its careful attention.

If, in conjunction with the establishment of a sample room under these circumstances, a direct line of steamers could be induced to operate regularly between New York and the Syrian coast, touching either outward or homeward bound at Alexandria, a decided advantage would be gained for American foreign trade. As already stated in Consular Reports (by Consul-General Dickinson, at Constantinople), Barber & Company, Produce Exchange, New York city, have inaugurated a line for Smyrna, Constantinople, and Black Sea as well as Grecian ports. One of their steamers is now on its way, sailing direct from New York to Beirut. It will call at Alexandria on the return trip. Another steamer of the same company leaves New York for this port about July 10. This route should be permanently adopted, and it rests with American manufacturers to bring about this important result.

Railways in the Transvaal.—Consul Macrum, of Pretoria, on July 6, 1899, writes:

Referring to my report of June 13, 1899, construction of the Rustenburg and the Lydenburg railways, I have to state that a notice has been published extending the time for the sending in of tenders on the construction of the Rustenburg line until Thursday, October 12 next, at noon. This is done for the purpose of allowing foreign contractors time to bid, and makes the time on both the Pretoria-Rustenburg and the Belfast-Lydenburg lines the same.

Work on Guayaquil Railway.—Minister Sampson, under date of July 17, 1899, writes from Quito that on the 16th instant active work was begun in the construction of the Guayaquil and Quito Railroad. A United States company is interested in this work.

Operation of Japanese Copyright Law.—Minister Buck writes from Tokyo, June 30, 1899, that, according to an imperial ordinance published on the 28th instant, the new copyright law will be enforced on and after July 15, 1899.

INDEX TO ADVANCE SHEETS OF CONSULAR REPORTS.

The Reports marked with an asterisk (*) will be published in the SCIENTIFIC AMERICAN SUPPLEMENT. Interested parties can obtain the other Reports by application to Bureau of Foreign Commerce, Department of State, Washington, D. C., and we suggest immediate application before the supply is exhausted.

IN THE PHILIPPINES.

THE resistance which the United States have encountered in taking possession of the islands ceded to them by Spain in the East Indies is merely a continuation of the obstinate struggle which the natives have long waged for political independence. For a neutral nation, it is difficult to determine with which side it should sympathize. A race which battles for its independence is always sure of sympathy, especially when it is compelled to fight by such misgovernment and oppression as prevailed only too long in the Philippines under Spain's rule. On the other hand, the great American republic has lost in prestige, since it has broken away from its traditions, entered upon a career of conquest, and directed its weapons against a people struggling for liberty. But the battles with the natives are fought, not in the name of despotism against liberty, but of civilization against barbarism. Conditions such as the insurgent Tagals dream of could never be realized in the Philippines; and, if attained, could never last. Lamentable though it be that these Tagals, who are not incapable of being civilized, have been deprived of the blessings of civilization, it must be confessed that they have retained much of the barbarity of a savage people. They may possess many high and admirable qualities, but among these is not the capacity of forming a permanent government. That of which they have for centuries been willfully deprived, cannot be developed overnight. Of the result of the struggle there can be no doubt. The Americans may be compelled to make even greater sacrifices than they have already offered up; but eventually they must win. The foreigners in Luzon, and particularly in Manila, would welcome the American possession of the islands; for that which they have acquired by long years of hard labor would be jeopardized if the Tagals gained the upper hand.

AGUINALDO.

The revolt against Spanish rule was fostered chiefly by lodges of the Freemason type, with expressed political tendencies. When, about 1885, the united *gobernadorcillos* had petitioned the Spanish Captain-General to institute certain much-needed reforms in ecclesiastical matters, and when this effort, like those which had gone before, proved fruitless, discontent was bred throughout the islands, which soon found expression in a many-branched secret society. The organs of this secret society were the lodges mentioned, the members of which were mostly of the colored race. The conspiracy had penetrated even into Manila before the Spanish authorities suspected its existence. The church was more vigilant; for the veil of the mystery was lifted by Pater Mariano Gil, the pastor of Torido, a suburb of Manila. Not until the priest revealed the plot did the Spanish government officers act. In August, 1896, a number of colored compositors on the Manila paper Diario de Manila were arrested for printing incendiary placards and handbills on the press of the paper. The arrest of these men aroused such terror that, on August 31, all the shops in Manila were closed. The foreign residents formed a league, the object of which was to induce Captain-General Blanco to take the necessary steps to suppress the conspiracy. But the Spanish government was never noted for rapidity of action; and, despite the fact that the officials were fully informed of the true state of affairs, the city of Manila would have been looted had it not been that at the decisive moment a company of Spanish artillery, who, uniting with the native city police (*guardia civil veterana*), repelled the rebels, who had penetrated into the city from the side of Santa Mesa. When, finally, they had overpowered the insurgents, the Spanish officials acted with extreme cruelty. On the 3d of September the inexorable fusillades began on the "Lunetta"; and in a few days the small fortress of Santiago, at the mouth of the Pasig, was filled with prisoners. Among those who were executed on the "Lunetta" was Dr. Rizal, patriot and poet, who had the sympathy even of most of the white inhabitants, and who is now regarded by the Tagals as a martyr.

In the meantime the rage of the natives was directed with increasing violence against the priest at whose door the failure of the original plans was laid. He was overwhelmed with threatening letters.

The measures taken by the Spanish, although cruel, led to no definite end. In the very same month of September (1896), the rebels in the province of Cavité again revolted, and defeated the Spaniards at Novetta, a small fortified place between the city of Cavité and Imus. It was on that occasion that the now famous Emilio Aguinaldo first appeared as leader of the rebels. It was long before the Spaniards overcame the defeat sustained at Novelleta. Although fresh troops were brought from Spain, and although Blanco was succeeded by General Polavieja, the Spanish soldiers were compelled to retreat before their opponents. When Polavieja finally surrounded the insurgent army, so that he had it at his mercy, he received orders from Madrid which completely prevented him from taking decisive action. Angered, he handed in his resignation, and was superseded by Primo de Rivera. The new commander succeeded in establishing peace; but it is not known to this day by what means. It is rumored that he bought over Aguinaldo for 500,000 pesos. What foundation this report may have, we do not know. The fact remains that Aguinaldo left for Hong-Kong soon after the arrival of Rivera, where he remained until the outbreak of the Spanish-American war.

The events which followed are too well known to need extended comment. The Tagals had at first hailed the Americans as liberators, and performed no small services for them. But they were chagrined at not being allowed to enter the capital of their country side by side with the victorious American troops. Gradually they came to the conclusion that the defeat of the Spaniards would not bring them that which they hoped—a free, independent Tagal government. On February 14 of the present year they revolted against American rule as they had risen up against Spanish oppression. The suppression of this last rebellion is a question only of time.

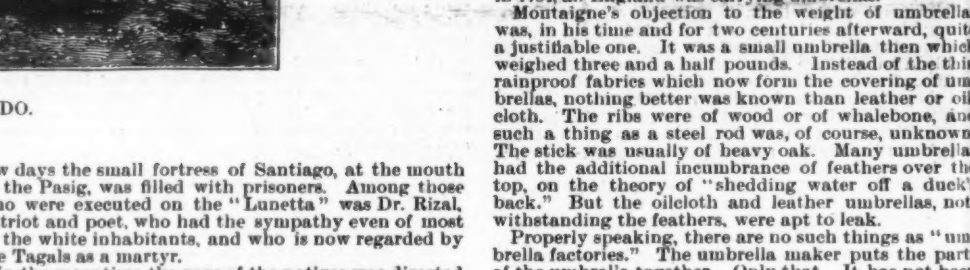
The illustrations which we present to our readers are taken from Ueber Land und Meer and Le Monde Illustré.

THE HISTORY OF THE UMBRELLA.

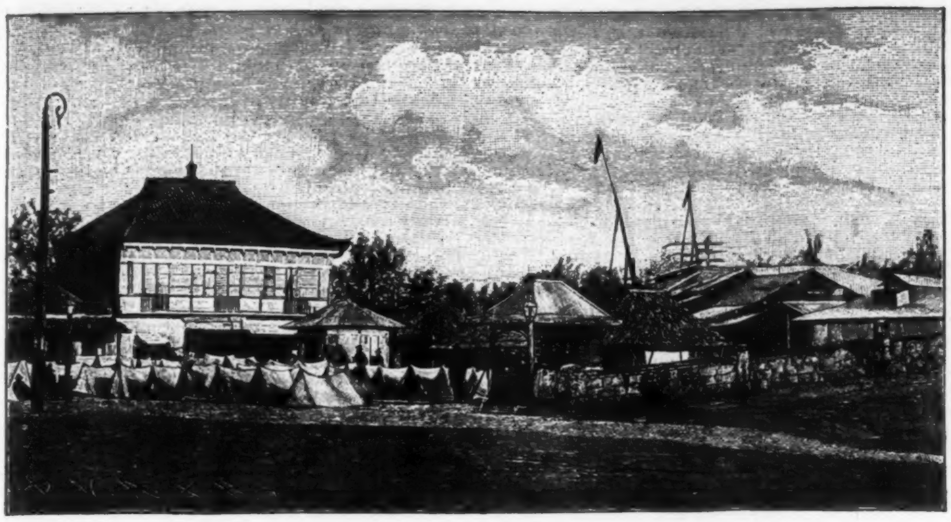
IT is almost impossible nowadays to imagine a person who could object to carrying an umbrella in the rain. Yet Montaigne, who lived three centuries ago, declared that the umbrella was "a greater burden to a man's hand than relief to his head." Later than this, in Addison's time, in London, there was much ridicule of a certain man who, leaving the famous Will's coffee house, sent back for an umbrella when he found it was raining. The facetious host sent a message with the umbrella—there was only one umbrella in the entire establishment—and the dainty man was informed that if he would return to the coffee house he might have "the maid's pattens" also. If a man appeared on the streets of London publicly with an umbrella in the early part of the eighteenth century, he was sure to be treated with gibes, cries of "Frenchy, don't you want a coach?" and the like. The first man who dared openly to meet this storm of ridicule is said to have been the famous philanthropist, Jonas Hanway, who was born 1712. He had a great deal of fun poked at him, but he continued to carry his umbrella whenever it rained, and others soon had the courage to follow his example. At the time of his death, in 1784, all England was carrying umbrellas.

Montaigne's objection to the weight of umbrellas was, in his time and for two centuries afterward, quite a justifiable one. It was a small umbrella then which weighed three and a half pounds. Instead of the thin rainproof fabrics which now form the covering of umbrellas, nothing better was known than leather or oilcloth. The ribs were of wood or of whalebone, and such a thing as a steel rod was, of course, unknown. The stick was usually of heavy oak. Many umbrellas had the additional incumbrance of feathers over the top, on the theory of "shedding water off a duck's back." But the oilcloth and leather umbrellas, notwithstanding the feathers, were apt to leak.

Properly speaking, there are no such things as "umbrella factories." The umbrella maker puts the parts of the umbrella together. Only that. It has not been many years since almost everything used in making an umbrella came from the old world. The steel rod, which by processes discovered about three years ago was made possible for the cheaper as well as the high priced umbrellas, was up to that time always an imported article. Two years ago it began to be extensively manufactured in America, and, like the other component parts of the umbrella, is now sold in this



A BODY OF AGUINALDO'S TROOPS.



AN AMERICAN CAMP IN THE CITY OF MALOLOS, LUZON.

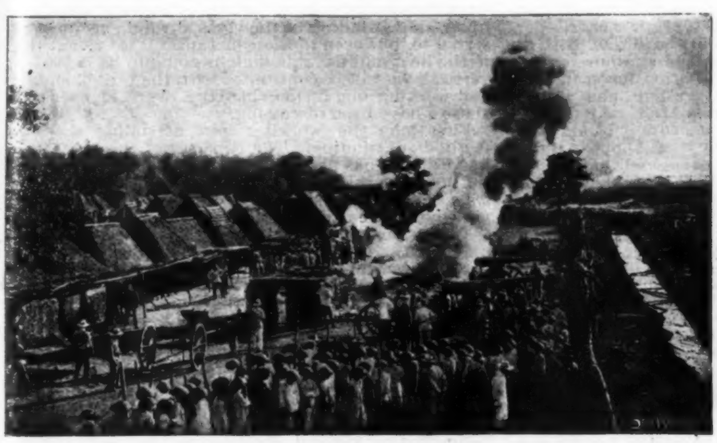
country in better quality and at a lower price than it can be obtained across the sea. The factories which make umbrella steel rods make the rods and nothing else. The manufacturing of umbrella steel frames is an entirely separate industry. There are four large steel frame factories in America. It was a great discovery when steel frame manufacturers found that hollow steel ribs were just as good as solid ones. As the smallest umbrella has at least seven ribs, this discovery lessened the weight of umbrellas very materially. The common paragon frame has eight ribs. Some umbrellas, the kind that are called "family umbrellas," and are good to go fishing with, have as many as sixteen ribs. It is not quite fifty years since the paragon frame was invented. It was patented by Samuel Fox, an Englishman, in 1852, and has had more to do with imparting strength, lightness, and elasticity to the umbrella than anything else.

A book could be written about the various materials from which umbrella handles are made. The partridge, or lorie, as it is called in France, is one of the best natural woods. It comes from a tree of Africa, and is hard on the outside and soft on the inside. The Arabian vine is a beautiful, extremely hard wood. Another is the Weichsel. "When a young lady comes in and says she wants an umbrella handle that smells like ice cream," said Mr. Louis Onimus, a South Broadway umbrella maker, "I immediately know that she wants a Weichsel." Congo pieces are distinguished for the natural wood knots, which occur at exactly regular intervals. The Malaga is a shining, straight, smooth stick, susceptible of a very high polish. Bamboo is used a great deal, and also rattan. Ebony, pearl, rosewood, silver, Dresden china, pearl and ivory are some of the popular materials for high-priced umbrella handles.

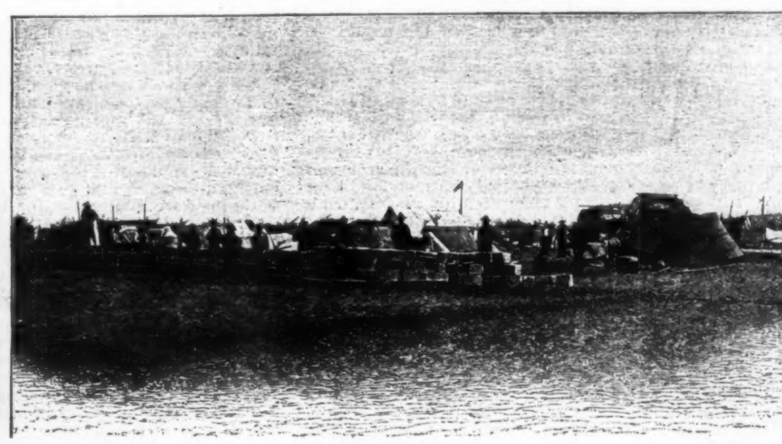
Solid gold handles are never found in the ordinary umbrella or jewelry store, and are made only when specially ordered.

Many curious umbrellas come to the umbrella mender's shop. One which is being mended just now can be taken apart and put in one's pocket. The stick is of wood, about an inch in diameter. The cover can be turned inside out and folded into a small bundle. By touching a spring the ribs come off, straighten out, and may be placed in the hollow of the stick, which is then a presentable walking stick. It is found very convenient by its owner, who is a drummer. Another that was lately mended is still more ingenious. The handle is curved, and when a spring is pressed a pipe flies out. The ribs are stowed away in the center and the owner has a walking stick, but in the center there is also a rapier, which may be drawn out. Another neat invention is a hollow stick which contains a camp chair. Three steel supports are pressed out of the top of the stick, a triangular piece of canvas put on, and a seat is had which is at least as comfortable as a bicycle saddle. All of these strange umbrellas come from the Old World. The umbrella makers say that Europeans take much more pride in their umbrellas than do people of this country. Many little jokes are concealed in the umbrella handles there. A handle may present the appearance of the head of a monkey or a cat or some other animal, and a secret spring will cause the little creature to open its mouth and spit a drop of cologne on the beholder.

A crescent shaped handle in very common use is known among dealers as the "Prince of Wales crook." This is not so remarkable as the insignia which the King of Siam has conferred on Queen Victoria and on the Emperor of Germany, the "Collar of the Order of the White Elephant of Siam." The decoration consists of two pyramids of nine umbrellas each, set on either side of a triple white elephant. It is reserved exclusively for crowned heads, since in Siam, as in India, China, Burma, and other Asiatic countries, the carrying of an umbrella is a mark of rank. One of the titles of the King of Burma is "Lord of the Twenty-four Umbrellas."



THE DEFENSE OF MALOLOS.



A FORTIFIED AMERICAN CAMP.

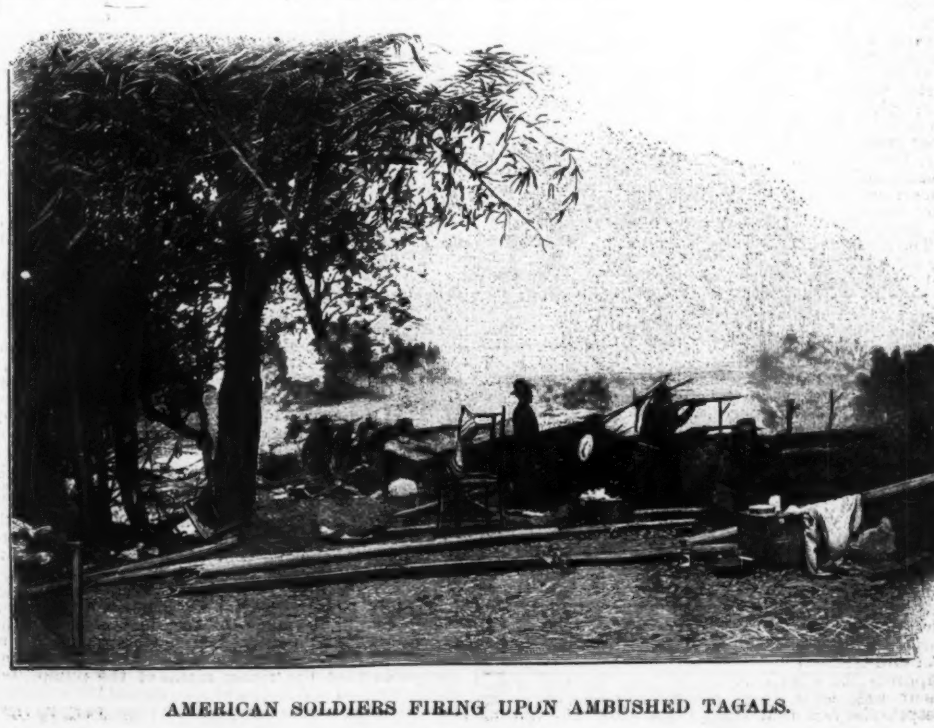
In China there are umbrellas of the most costly brocades and silk stuffs which those in high life may use. But the common people in China dare not use an umbrella of any kind of cloth or of anything but paper. This is not so great a hardship as might be supposed, since the Chinese can manufacture paper umbrellas of a wonderful degree of hardness which are capable of withstanding a severe storm. It is not uncommon in China to see umbrella covers embellished with profound philosophical sentences from Confucius. The Japanese, on the other hand, decorate theirs with light and airy designs, artistic and fanciful.

The umbrella is of very ancient origin. It is found on designs on Greek and Etruscan vases, and is traced back to ancient Egypt, the mother of arts. Its first use was undoubtedly to protect from the burning rays of the tropical sun; its Latin derivation is from umbra, a shade. A curious statement about this is made by an early Italian writer. "I do not think much of umbrellas," he says; "a physician told me they were dangerous, because they gathered the heat in a pyramid and thence threw it down on the head." There were superstitions that the umbrella was sacred in all the Oriental countries. The early Christian church, just as it made St. Valentine's day out of a former heathen festival, began also to transmute this reverence for umbrellas into something in keeping with Christianity. In a manuscript left in a monastery ages ago, the margin is illuminated with strange designs of umbrella-like trees, suggestive at the same time of the cross or "tree" on which our Lord was crucified and the umbrella of the Orient. Later, in the twelfth century, the Pope permitted the Doge of Venice, in his state processions, to have suspended over him a gorgeous umbrella of gold brocade, at the summit of which was a small gold statue of the Annunciation.

History shows that the umbrella came from the East, reaching first Italy, then Spain and France and afterward England and Germany. The pendulum now is swinging back again and the last commercial statistics show that the city of Paris is exporting 600,000 umbrellas annually to Turkey, while in England in one year 819,000 umbrellas were manufactured for shipment to Burma.

The use of alpaca covering was patented in 1848 by William Sangster, an Englishman. The variety of coverings has rapidly increased, until now more than fifty kinds of gloria silk alone are used. The genuine German gloria is regarded as one of the best makes. Taffetas also are freely used, as are many combinations of silk and wool, silk and cotton and silk and linen.

Daniel Defoe made a hit which will never be forgotten when he described the efforts of Robinson Crusoe to make an umbrella for himself on his desolate island. In Paris an umbrella is often spoken of as "un Robinson," in memory of the story. So with Dickens' Sairey Gamp and her immortal umbrella. A "Gamp" is English slang for an umbrella.—The St. Louis Globe-Democrat.



AMERICAN SOLDIERS FIRING UPON AMBUSHED TAGALS.

MINING ON THE WITWATERSRAND TO 12,000 FEET DEEP.*

By JOHN YATES.

IN taking up the problem of extending the deep level workings on the Witwatersrand to still deeper levels, we will find that, as it is unlikely that there will be any necessity for material departure from present methods for blocking out the reef for stoping, it resolves itself mainly into a matter of shafts, their position, number, and size, and the method of hoisting in them. The features of the auriferous banket beds of the Rand are such that there is no reason to apprehend that their extent to the dip is very limited; on the contrary, the evidence available practically places beyond doubt that they will continue in depth far beyond a point where high temperature will render mining operations impossible. Where is this limit of work as fixed by temperature likely to be? Mr. Seymour has informed us that specifically conducted experiments have discovered a rise of 1° F. for every 203 feet of vertical depth. If, therefore, we assume that the average temperature at a depth of 1,000 feet is 72° F., that the maximum air temperature in which men and boys can do a shift's work is 100° F., and that this corresponds, say, to a rock temperature of 125° F., we find that the limit of work by temperature is 12,000 feet vertical, so that unless we are favored with a series of upthrow strike faults—a not unlikely contingency—the pegging of claims more than 4 miles from the outcrop will probably prove a waste of both time and money. In the headings and rises the difference between the temperature of the rock and that of the air is not likely to be so great as that mentioned, owing to the less perfect ventilation, and for these, at a depth of 12,000 feet, compressed air or other means of cooling the atmosphere would be needed to create a bearable temperature.

In shaft sinking, the temperature limit would also be less than 12,000 feet vertical; the imperfect ventilation and the presence of a crowd of men and boys will probably make it 7,000 feet—a limit which, of course, could be extended by supplying the sinkers with cooled air; but it is open to question whether men and boys will be easily found who will sink vertical shafts to a depth of even 7,000 feet.

In view of the fact that the practicability of working at a depth of 5,000 feet is not infrequently questioned, the idea of working to a vertical depth of 12,000 feet will, I am afraid, be generally regarded as too visionary to call for serious discussion, but future operations will disillusionize those who think that our limit is going to be anything like 5,000 feet vertical.

In order to discuss this question, I will assume that it is practicable to put down a 9,000 foot vertical shaft, that the third row of deeps with their 5,000 foot shafts have 8,000 feet of reef measured on the dip, the reef leaving the property at 9,000 feet vertical, and that from this to the 12,000 foot vertical limit constitutes a fourth row of deeps, with 6,000 feet of reef on the line of dip.

Present operations having placed the prospects of 5,000 foot deeps practically beyond doubt, these might be taken in hand without delay, but it is not likely that a 9,000 foot shaft for the fourth row is going to be started without some positive evidence of the value of the ground at that depth. Such evidence could be obtained either by a borehole—though to put such a hole down would probably tax our resources to the utmost—or by the sinking of the inclines of the third row of deeps.

Testing by borehole, though very convenient, is unsatisfactory where such enormous interests are at stake. Their disclosures are too local and too limited. On the other hand, the incline shafts of the third row of deeps would not only indicate, with some approach to accuracy, the size and value of the reef at the lower depths, but also the temperature, the quantity of water, and the nature of the formation likely to be met with, whether disturbed or not; in fact, they would yield information which would enable prospects to be judged almost to a nicety. These considerations are strongly in favor of testing by the incline shafts. But it might be urged that to do this would inconveniently delay the opening up of the lowest deeps. This, however, is not the case, provided that the shafts of the third deeps are put down with a view to also serving the fourth deeps, and thus doing away with the need for verticals on the latter. Calculating on the present rate of sinking in the stiffer ground of the Central Rand—rates which will undoubtedly be improved on in the future—the sinking of the verticals and inclines of the third row of deeps would take: 5,000 foot vertical at 90 feet per month, 55·5; 8,000 foot incline at 100 feet per month, 80; total, 135·5 months; while to put down a 9,000 foot vertical shaft—assuming it possible—on the fourth deeps, to reach the same point would, allowing 75 feet per month, take 120 months, or practically the same time. In other words, the reef of the fourth and final row of deeps can be reached and opened up as quickly by the verticals and inclines of the 5,000 foot deeps as by vertical shafts sunk within their own boundaries, presupposing that there is no material upthrowing of the reef by reverse faults. This is favorable to working such fourth deeps through the shafts of the thirds, or to go a step further, to having the third row of deeps work to the heat limit, opening them up in a manner comparable with the claim area and thus have the full number of stamps allotted to this area dropping much sooner than would be the case if the claims were divided into independent third and fourth deeps.

The total length of incline working to the heat boundary through the 5,000 foot shafts would be 14,000 feet, so that winding in four stages in this distance would probably suffice and constitute a satisfactory working arrangement. Doing all the hoisting through the 5,000 foot shaft would be a little more costly for power than having the 9,000 foot vertical for the lower section of the reef, inasmuch that the ore from this section would be pulled 8,000 feet along the incline instead of 4,000 foot vertical; but against this there would be the saving of wages and of maintenance due to there being one shaft instead of two.

It will be noticed that this idea of working out the reef to the heat limit through 5,000 foot verticals would do away with the need for stage winding in verticals, for one-stage winding from this depth can not only be done, but is an accomplished fact. It is not that there are any engineering difficulties connected with stage winding in verticals, but I think that although stage winding on inclines would give every satisfaction, it should not be introduced into verticals except where absolutely necessary—the simpler we can have vertical hoisting the better. There would appear to be nothing simpler than one-stage rope hoisting, and about 5,000 feet is apparently the present limit for this, so that by having shafts of this depth, with one-stage hoisting, we apply the maximum of power direct, thus avoiding some of the loss connected with the transmission of power to motors underground.

Before proceeding further, I would like to touch upon what we may see on these deeper levels regarding the relation of the number of shafts to the number of claims and stamps. The great expenditure, both capital and working costs, which these shafts will entail will compel us to keep their number down to the lowest possible. Now the number of shafts in undisturbed ground is influenced mainly by the requirements of the law, by ventilation, hoisting capacity, underground tramming, the time taken by men and boys to reach their working places and capacity for development.

The law permits of any property having only one shaft, provided that this is connected up with another, so that as all the deeper levels will ultimately be connected up on one or more of their boundaries they may have but one shaft. Let us see, therefore, whether one of these contemplated 5,000 foot shafts is adequate for working, say, 1,000 claims and supplying 400 stamps. Take the 1,000 claims to be a rectangular block extending 11,900 feet horizontally to the dip (to the heat limit) and 5,000 feet along the strike. The distance between this shaft and that of an adjoining property similarly laid out would be a little less than a mile, and the longest tramming and drive would be about half a mile. The ultimate length of the incline shaft would be about 14,000 feet.

To supply 400 stamps each underground shift would have to number about 2,000 men and boys. Allowing 70 cubic feet of air per man per minute and an air velocity in the downtake section of the shafts of 1,500 feet per minute, I find that a bratticed shaft 38 × 7 feet, inside timber, would serve both as downcast and upcast for the 140,000 cubic feet of air needed per minute. With large fans placed in the intake, both at the bottom of the vertical and at the stations on the incline, with an independent ventilation for each pair of levels by means of supplementary fans, and with a fan on the surface at the upcast, the maintaining through one shaft of an adequate supply of air even at the extreme southern boundary would appear quite feasible. Further, it must be remembered that the securing and maintaining of very liberal ore reserves for 400 stamps would not call for the incline shafts to be down more than 4,000 feet below a level connecting the two shafts, and that by the time the full milling stage was reached, in about 3½ years after cutting the reef, the two shafts would have sufficient levels connected—ten—to permit of a joint system of ventilation.

The first level would be connected in 27 months after cutting the reef as against the 10 to 12 months of some of the present deeps, and if we can carry on a one-shaft ventilation for the latter period, what difficulty is there in the way of extending it to the former time, more especially seeing that the ventilation will be a mechanical one, and that with fans, etc., there is no very great difference between ventilating a 2,500 foot drive and one of half the length. During 23 years out of the 26 years of its life after cutting the reef, the property would really be a two-shaft proposition in everything but hoisting.

In the matter of development, the width of the property influences the capacity of a shaft. Thus, with the lateral boundaries 2,500 feet distant from the shaft, it would take 27 months to connect, driving at the rate of 90 feet per month, and in this time the incline would be sunk 2,700 feet at the rate of 100 feet per month. Taking the levels as being 150 feet apart, the number of these unconnected would be limited to 18, and the number of development machines driving to twice this, or 36. Therefore, for the development to keep pace with the 400 stamps, it would necessitate each machine opening up only 1,700 tons per month, thus allowing an ample margin even on a 3 foot milling width.

I would here point out that placing the shafts but 2,500 feet apart—like those of the present Angelo Deep—instead of 5,000 feet does not increase the ultimate average monthly development capacity of the property, which is explained by the fact that development must wait on the incline shafts.

The underground trams, I have already pointed out, would have a maximum run to the shaft of about half a mile, a not excessive distance.

Coming now to the important matter of hoisting capacity, with the 38 by 7 foot shaft needed for ventilation, I find that taking the 5,000 foot vertical section first, if this is divided into five 7 by 7 foot compartments—four hoisting and one pumping compartment—that with four 10-ton skips (the same size as in the Red Jacket shaft of the Calumet & Hecla Mine), and an average hoisting velocity of 2,500 feet per minute, each pair of skips would raise 1,400 tons per 12 hours, or 2,800 tons (sufficient for 400 stamps, allowing for 30 per cent. waste being sorted out) for the four compartments in the same time. By continuing this 38 by 7 foot shaft on the incline to the heat limit, and having four winding stages, each of 3,500 feet length with 10-ton skips, and an average velocity of 1,800 feet per minute, the hoisting capacity of the incline would equal that of the vertical, and it will be noticed that by having the skips and velocities stated the hoisting in both vertical and incline is really in duplicate—one pair of compartments could, if necessary, supply the 400 stamps by hoisting the whole 24 hours.

The preservation of the shaft timbers in these deep levels is a matter of vital importance, and arrangements should be made for keeping the timber thoroughly wet, this not only effectively preventing dry rot, but doing away with any possibility of fire. It is also advisable that the rising mains of the pumps, both in the vertical and incline shafts, should have branches for hose connections for special or emergency service.

In the ordinary course the night shifts would be available for repairing the shafts, and having bins of four days' capacity underground, and of the same capacity on surface, would tide over any stoppage of hoisting which might be reasonably expected.

Then the capacity of inclines is limited. Compared with verticals, the speed attainable is less, but, nevertheless, the capacity is much as you make it, and is directly proportional to the velocity, the size of the skip, and the number of stages introduced. If, for instance, you substitute two stages for one of similar velocity and size of skip, you double the capacity by really reducing the length of hoist to half the former distance. Thus, by dividing a 14,000 foot incline into four stages of 3,500 feet each the incline has the same capacity as a single stage of the latter length.

With the hoisting system mentioned and 4-deck cages in the vertical and coupled skips on the incline, carrying 80 men at a time, the whole shift could be put down in an hour, which is the time it would take to put a 200-stamp shift down a 6,000 foot vertical shaft using 4-deck cages carrying 36 men. The nearer working places would be reached in a few minutes, and it is of interest to note that even if one hour is allowed between shifts for the clearing of fumes and a man is the last of his shift to descend and the first to ascend, he would still be able to put in seven hours' work on the remotest part of the property, a time quite sufficient for a fair machine man to put down four 5 to 6 foot holes in a stope.

To put 80 men in a cage might be objected to by some as involving too many lives in any one catastrophe; but if such an argument is to be admitted, we must also object to any steamship or train carrying more than say a dozen persons for the same reason. The objection applies as much in the one case as the other.

From these considerations it is apparent that there is much that might be urged in favor of working everything below 5,000 feet vertical through shafts of this depth which do not need stage winding, allotting each shaft 1,000 claims and 400 stamps, thus giving the property about 23 years milling life on the moderate basis of a 3 foot milling width.

Of course it is likely that there will be isolated cases where circumstances will make it advisable to have the deepest vertical shafts possible, say 7,000 or 8,000 feet, when unless the present quality of ropes is improved upon, stage winding in the vertical will have to be resorted to, but even in these instances it is evident that if the heat and payable limit is going to be 12,000 feet vertical, we will be confronted with the task of sinking and working long inclines merely a degree shorter than those I have been discussing.

First take the working costs attending the two methods of winding. The capacity of the shaft is taken as 1,400 tons per day.

I find that, with three stages instead of one, the extra cost for wages, stores and coal is about 7d. per ton milled, and even allowing for renewing the more costly 6,000 foot ropes every two years, there still remains a difference of over 5d. per ton milled to speak in favor of a direct wind to this depth. For an 8,100 foot vertical shaft I would consider a two-stage wind practicable, and preferable both on the score of simplicity and economy.

Coming now to the capital expenditure needed by the shafts of the future, I will take the hypothetical 1,000 claims, measuring 5,000 feet on the strike by 11,900 feet to the dip, and find how the expenditure is affected by working the whole of this area through a 5,000 foot vertical and an incline, as against working it through two vertical shafts—one 5,000 feet and the other 9,000 feet deep—with inclines.

With the first system we would have: 1 vertical shaft, 5,000 feet deep, 38 by 7 feet (inside timber), at, say, £42 per foot; £210.000; 1 incline shaft, 14,000 feet long, 38 by 7 feet (inside timber) at, say, £80 per foot; £420,000; total, £630,000.

With the second system we have: 1 vertical shaft, 5,000 feet deep, 26 by 5 feet 6 inches (inside timber) at say, £26 per foot, £130,000; 1 incline shaft, 8,000 feet long, 26 by 5 feet 6 inches (inside timber) at say, £20 per foot, £160,000; 1 vertical shaft, 9,000 feet deep, 26 by 5 feet 6 inches (inside timber) at say, £32 per foot, £288,000; 1 incline shaft, 6,000 feet long, 26 by 5 foot 6 inches (inside timber) at say, £23 per foot, £138,000; total, £716,000.

These figures, which are necessarily very rough approximations, are exclusive of the surface and underground power installations and ropes, which would add materially to them, but would not, I think, greatly affect the differences shown.

The magnitude of the figures is such as to attract attention, but dividing the sum by the number of claims gives only about £700 per claim, which compares favorably with the £600 of some of the properties at present working.

If I now take a case where the 1,000 claims, measuring 5,000 feet by 11,900 feet, are given two shafts instead of one, each consisting of a 5,000 foot vertical and a 14,000 foot incline, I get two 5,000 foot verticals, 26 feet by 5 feet 6 inches (including timber) at, say, £26 per foot, £260,000; two 14,000 foot inclines, 26 feet by 5 feet 6 inches (inside timber) at, say, £22 per foot, £616,000; total, £876,000.

The capital expenditure is thus increased £246,000, or £246 per claim, a figure which would be considerably augmented by the more expensive power installation needed by the two shafts as compared with the one. Further, the extra shaft would increase working costs by about 3d. per ton milled for wages alone; to this would be added extra coal, stores, and shaft maintenance.

The certainty that the working of the 5,000 foot deeps will result in improved mining methods and appliances being discovered is of itself a plea for the postponing for a time of work on deeper zones, and indirectly favors everything below 5,000 feet being worked through the 5,000 foot verticals.

Whether the saving effected by giving the block of 1,000 claims mentioned one shaft only and one mill of 400 stamps is dearly purchased at the cost of the concentration of hoisting, longer headings, levels, and shafts to ventilate, the longer underground tramming, and the risk of trouble arising from disturbed ground and complicated workings, is a matter upon which there may be difference of opinion; but as this saving amounts in the case of substituting two shafts to over

* Abstract of paper read before the South African Association of Engineers at Johannesburg, July, 1899.—From The Engineering and Mining Journal.

£700,000, and in the case of substituting four shafts (two of them lower deeps) to over £2,000,000 for capital expenditure and working costs connected with the sinking and equipping and working of the shafts—exclusive of interest—during the life of the mine, it is not a point for hasty decision. In these cases it is assumed that the 1,000 claims are given one mill of 400 stamps; if instead of this two independent ones of 200 stamps each are erected, the capital expenditure per claim and the working costs will be still further increased. But if the magnitude of the interests at stake call for an excess of caution in the laying out of the work, even at the expense of increased capital charges and working costs, then would not three 5,000 foot shafts—one central one of 400-stamp capacity and two side ones, each of 200-stamp capacity—placed about 3,300 feet apart along the strike, quite suffice for two such properties as are mentioned (each with 400 stamps and 1,000 claims) and fully meet the case?

Before concluding my remarks I would like to enlarge somewhat on the matter of ventilation. In order that the working places about the downcast shafts of these southern deeps may not receive an undue share of the fresh and cool air to the detriment of the working places about the upcast shafts, it is, I fancy, not unlikely that special attention will be paid to making the levels efficient air mains, and to this end their walls will doubtless be kept as intact as possible, each stope receiving a regulated supply of fresh air from its lower level and discharging an equivalent quantity of foul air into its upper level. In this way a portion of the air from the downcast shaft will travel along the level direct to the last stope, but will, of course, be fouled to the extent of the air taken up from the other stopes, the result, however, being a more equable ventilation.

The temperature of very deep mines will depend greatly upon the relation of the temperature of the rock and the extent of the excavations to the volume and temperature of the air sent down, but a point is rapidly arrived at where the cost of obtaining improved air conditions, so far as sinking extra shafts is concerned, is likely to be out of all proportion to the slight betterment of atmosphere obtained.

In conclusion, you will observe that these notes are not so much a critique of stage winding in verticals as an argument to show that the depth of our shafts may be such that stage winding might not be needed—at least to any extent. Our experience with the 5,000 foot deeps will afford the safest basis for deeper work, but on the score of simple hoisting, economy in both capital expenditure and working costs and thorough proving of reef and working conditions before spending large sums of money, there is evidently something to be said in favor of working the enormous intact area of reef lying within the heat and payable limit through 5,000 foot one-stage verticals, allotting a maximum of 400 stamps to each shaft and having the size of the latter and the property commensurate with this stamping basis.

EXPERIMENTS ON THE STRENGTH OF GLASS.

THE extensive use of glass in construction renders definite information about its resistance under various conditions of stress desirable, but with the exception of the ultimate strength under direct compression, but little has been known about the subject until recently.

A series of experiments upon the resistance of glass to tension and to flexure has recently been made by M. Grenet under the auspices of the Société d'Encouragement pour l'Industrie Nationale, the details and results being published in the Bulletin of the society. The glass tested was of two varieties, manufactured by the well known works at Saint-Gobain, one being the grade known as No. 4, and the other the so-called "cathedral glass," and there being but little difference between the two shown by chemical analysis.

In the flexure tests the specimen was placed as a beam, supported on knife edges and with the load applied in the middle, the weight being a bucket suspended from a cross bar and arranged so that water dropped regularly into it from a separate vessel. The load could thus be applied at a uniform rate without the possibility of shock, and the rate of application kept under perfect control. By applying the usual formula for rectangular beams loaded in the center, the tensile strength per unit of cross section was determined.

The most interesting feature which was developed by these tests was the marked effect produced by variations in the rapidity with which the load was applied. It is well known that for nearly all materials a rapidly applied load will show an apparent resistance much greater than appears when the stress is applied more slowly, but in the case of these tests upon glass the effect is especially marked. Thus the tensile strength of a number of specimens averaged 6,000 to 7,000 pounds per square inch when the load was applied at a rate which caused the rupture to occur in 15 to 20 minutes, while when the duration of application was increased about three times, so that rupture occurred in about 45 minutes, the strength ranged between 5,000 and 6,000 pounds per square inch. When the water-dropping device was arranged for very slow loading, and the breaking load was attained in 10 to 12 hours, there was a marked diminution in strength, the resistance per square inch being only about 4,200 pounds.

In order to show the reverse effect some tests were made with loads applied very rapidly, and the effect was most marked, the mean of three trials giving an apparent strength of 10,000 pounds per square inch.

A number of flexure tests were also made by M. Grenet upon glass rods, and these showed the same general results as regards the effect of rapidity of application of load. The actual strength of the rods, however, was higher than that of the plates, which was probably due to the difference in the method of manufacture. Thus when the rupture was produced in about 15 minutes, the strength was nearly 11,000 pounds per square inch, while when the time was extended to 45 minutes the resistance fell to about 9,000 pounds, and for the 12-hour tests the breaking strength was but 5,700 pounds. In order to carry this feature of the tests to an extreme limit, M. Grenet suspended various weights to rods and allowed them to remain for a number of days. The result showed that for loads of 3,000 to 3,500 pounds per square inch no rupture occurred even after the expiration of three months, but when the loading was increased to about 4,000 pounds, rupture took place in one or two days.—Engineering Magazine.

PERFUMERY FOR THE PHARMACIST.

By C. H. SEGUIN, Baltimore, Md.

LIKE a good many other things once cultivated by the pharmacist, the preparation of handkerchief extracts does not occupy the place it once held. The demand for bulk perfume has fallen off greatly of late, and the neat packages of special odors which are attractively labeled and advertised are much more salable. The pharmacist can, however, build up a demand for a special odor of his own by adopting a special formula and pushing the merits of the odor selected, which must bear a distinctive name. The formulas here given, says The American Druggist and Pharmaceutical Record, to which we are indebted, will appeal to the business pharmacist because of their practical form and the fact that the products yielded by them are relatively inexpensive.

CUBANA BOUQUET.

Oil cloves	10	drops.
Oil anise	5	"
Oil lavender	20	"
Oil bergamot	1	drachm.
Extract musk	2	"
Spirit tolu	2	"
Spirit orris	2	ounces.
Benzoic acid	24	grains.
Bitter almond water	1	ounce.
Spirit tonka	1	"
Deodorized alcohol	12	"

Mix.

ORINOCO BOUQUET.

Extract musk	4	drachms.
Oil jasmin	4	"
Oil rose geranium	2	"
Spirit civet	1	ounce.
Spirit orris	2	"
Spirit neroli	1	"
Coumarin	6	grains.
Deodorized alcohol	10	ounces.
Rose water	1	"

Mix.

MANILA BOUQUET.

Oil citronella	8	drops.
Oil cinnamon	8	"
Oil coriander	12	"
Oil neroli	16	"
Oil rosemary	30	"
Oil nutmeg	5	"
Oil cloves	10	"
Oil lavender	1	drachm.
Oil bergamot	3	"
Spirit lemon	2	ounces.
Coumarin	10	grains.
Deodorized alcohol	16	ounces.
Rose water	2	"

Mix.

ARINITA WATER.

Oil lemon	2	drachms.
Oil bergamot	3	"
Oil rosemary	1	"
Oil orange	2	"
Oil neroli	35	drops.
Oil cloves	15	"
Oil sassafras	8	"
Oil cardamom	20	"
Tonquin musk	2	grains.
Benzoic acid	28	"
Deodorized alcohol	14	ounces.
Anise water	2	"

Mix.

NANETTE BOUQUET.

Oil bergamot	5	drachms.
Oil neroli	30	drops.
Oil lavender	30	"
Oil cinnamon	10	"
Oil jasmin	1	drachm.
Oil rose	2	drops.
Extract musk	2	drachms.
Spirit benzoin	4	"
Spirit vanilla	3	"
Deodorized alcohol	15	ounces.

Mix.

ALASKA WATER.

Oil neroli	20	drops.
Oil lavender	30	"
Oil jasmin	1	drachm.
Oil bergamot	2	"
Oil cinnamon	4	drops.
Spirit benzoin	3	drachms.
Spirit musk	4	"
Deodorized alcohol	14	ounces.
Rose water	1	"

Mix.

CAYUGA WATER.

Oil cinnamon	6	drops.
Oil citronella	20	"
Oil lemon	1	drachm.
Oil rosemary	½	"
Oil bergamot	2	"
Oil lavender	1½	"
Benzoic acid	32	grains.
Deodorized alcohol	16	ounces.
Camphor water	2	"

Mix.

ONEIDA WATER.

Oil jasmin	1	drachm.
Oil patchouly	½	"
Oil rhodium	15	drops.
Oil rose geranium	30	"
Oil citronella	20	"
Oil orange	15	"
Oil bergamot	1	drachm.
Oil nutmeg	6	drops.
Oil bitter almond	2	"
Oil caraway	2	"
Benzoic acid	32	grains.
Deodorized alcohol	18	ounces.

Mix.

EXTRACT EALAUDA.

Oil asarum	40	drops.
Oil lemon	2	drachms.
Spirit Peru	1	ounce.
Oil jasmin	5	drachms.
Civet	30	grains.
Oil musk	1	drachm.
Oil lavender	3	"
Oil neroli	30	drops.
Benzoic acid	36	grains.
Deodorized alcohol	18	ounces.
Rose water	2	"

Mix.

EDITHIA BOUQUET.

Oil rhodium	30	drops.
Oil verbena	30	"
Oil jasmin	1	ounce.
Spirit ambrette	3	"
Spirit orris	2	"
Benzoic acid	20	grains.
Coumarin	15	"
Deodorized alcohol	12	ounces.
Cinnamon water	2	"

Mix.

CARLOTTE BOUQUET.

Oil rose geranium	1	drachm.
Oil sandalwood	½	"
Oil jasmin	1	ounce.
Spirit angelica	2	drachms.
Spirit musk	6	"
Aromatic spirit orris	6	ounces.
Benzoic acid	16	grains.
Deodorized alcohol	10	ounces.

Mix.

FLARZORA BOUQUET.

Oil bitter almond	10	drops.
Oil rose	20	"
Oil neroli	30	"
Oil sandalwood	25	"
Oil lavender	3	drachms.
Oil bergamot	3	"
Spirit civet	2	"
Spirit ambergris	2	"
Oil jasmin	4	ounces.
Spirit orris	11	"

Mix.

LICOLA BOUQUET.

Oil limet	3	drachms.
Oil citronella	½	"
Oil patchouly	1	"
Oil verbena	40	drops.
Oil rose geranium	2	drachms.
Oil asarum	1	"
Oil balm	2	"
Oil rhodium	½	"
Spirit vanilla	1	ounce.
Extract musk	1	"
Spirit orris	14	"

Mix.

OLYMPIA BOUQUET.

Oil musk	4	drachms.
Oil vanilla	1	"
Oil sandalwood	20	drops.
Oil cedrat	2	drachms.
Oil lavender	1	ounce.
Oil bergamot	3	drachms.
Oil jasmin	4	ounces.
Spirit orris	12	"

Mix.

EXTRACT AURORA.

Oil verbena	20	drops.
Oil cedrat	30	"
Oil rhodium	1	drachm.
Oil bergamot	1½	"
Oil jasmin	1	ounce.
Compound spirit vanilla	½	"
Spirit ambrette	1	"
Spirit orris	1	"
Benzoic acid	24	grains.
Deodorized alcohol	12	ounces.
Orange flower water	1	"

Mix.

EXTRACT BRONTA.

Mace	4	grains.
Cardamom	6	"
Oil orange	1	drachm.
Oil bergamot	½	"
Oil neroli	2	"
Oil jasmin	3	"
Spirit must	1	ounce.
Spirit angelica	2	"
Benzoic acid	26	grains.
Coumarin	8	"
Deodorized alcohol	13	ounces.
Rose water	1	"

Mix.

HOW CLAY PIPES ARE MADE.

THE clay from which the ordinary clay pipe is made is in its natural state of a slate color; it changes to white in firing, says The New York Sun. That used in pipe factories hereabouts comes mainly from Woodbridge, N. J. As received it is in chunks, large and small, and in dust, something as soft coal comes, and its color is not unlike that of cement. The clay is soaked in tubs for ten or twelve hours until it has been soaked into a mass, to prepare it for working. It is then put through a pug mill, in which it is mixed to make it of a uniform consistency and to bring it to the right temper; it should be like a stiff dough. As it comes from the pug mill it is made up into balls or bunches about the size of a peck measure. From the clay thus prepared for use without any admixture whatever the pipes are made.

The first step in the process is the working of portions of the clay into what are called rolls. A bunch of the prepared clay is placed upon a bench and the rollmaker picks off two lumps of clay which he lays on a board in front of him on the bench. He rolls both lumps at once, one under each hand, rolling them out into elongated tapering shapes, with the thick ends or heads toward the thumbs and the smaller ends tapering out at the little finger side of the hands. These are the first crude shapes of the pipe; though their resemblance to a pipe would not be detected if one did not know that was to be made of them; the roll

looks perhaps more like a horseshoe nail with a flattened head, and a round instead of a flattened nail; or it may be of a shape quite different from that; its shape and the length of the stem part depending upon the style of pipe to be made.

The rolls are laid on boards in bunches of dozens, and put away to stiffen; after ten or twelve hours they are ready for moulding. There are different kinds of moulds, varying in some minor details, but practically alike in operation. Some moulds are, however, much more elaborate in construction than others, the mould for an ordinary pipe being in two pieces, while the mould for a fancy pipe might be in half a dozen or more pieces. A pipe factory might have hundreds of different moulds for almost as many styles of pipes. Moulds for plain pipes are made of iron; those for elaborate styles are sometimes made of brass or other composition.

The mould for an ordinary plain pipe is of two parts, hinged at the bottom, and opening vertically lengthwise. By the pipemaker's side is a board of rolls. He holds by a handle at one end a wire that is to make the hole in the stem of the pipe. He picks up a roll and draws the stem part down on the wire; there is a hole in the stem of the pipe already made. He bends the head end up a little to make it go more easily into the mould, and that touch adds distinctly to the pipe look of the roll. He puts the roll in one side of the mould and shuts the mould up together, and puts it in a press, bowl up. The closing together of the parts of the mould upon the pliable clay has already shaped the pipe upon the outside, and there is a hole through the stem, the wire still remaining in it, but it has no bowl. A single turn of a side screw holds the mould firmly in the press. Over the press is a lever, to which is attached what is called a stopper; it is like a plunger attached to the under side of the lever by a pivot. When the lever is brought down, the stopper is forced into the clay in the head of the mould, and so the bowl is formed. The mould is taken from the press and the surplus clay around the edges of the mould, pressed out when the mould was shut together, is shaved off with a knife, the wire is drawn from the stem, and the now completely formed pipe is set aside. The celerity with which the work is done is surprising. An expert pipemaker can make seventy-five gross of common pipes in a week. Forty gross, however, would be about the average.

When the pipe comes from the mould, the clay is still damp. It is a little darker in shade than clay in its natural state. The bowl almost glistens in its smoothness. The new pipes are set away in racks to dry out somewhat before the next step in the process, the finishing. Ten or twelve hours in a temperature of 75° is sufficient. There remains on the pipe a little seam where the mould has come together. In finishing the pipe a wire is run through the stem again to clear the hole if there should be any obstruction, and the wire serves as a handle with which to hold the pipe. The seams are taken off, as is also a little burr of clay at the bottom of the bowl of the pipe over the hole from the stem. At this stage, too, the pipe is stamped with its brand, if it is to have one, if it is anything more elaborate than a simple letter or two on either side of the pipe. Designs are sometimes cut in the mould, but if it should be one across the pipe the mould seam would run through it, and a smoother finish could be given by stamping after the pipe had come from the mould. Now the wire is drawn and the pipe is set back on the board and the board is again placed in the drying rack; this time the pipes are to be thoroughly dried, and twenty-four hours is about the time required.

Then the pipes are put into saggers to be placed in the kiln. The sagger is a cylindrical shaped pot of fire clay, twelve or fifteen inches high, and of about the same diameter. The longer stemmed pipes are laid in the sagger with peculiarity; the shorter stemmed, such pipes, for instance, as are to be finished later with a stem piece of another material, and, perhaps, to be colored in imitation of meerschaum, and which have stems so short that there is no danger of bending them, are simply laid in loosely. On the average a sagger will hold about a gross of pipes; of some pipes more, of others less; depending on the size. The saggers, filled, are stacked up in the kiln in stands, a kiln of ordinary dimensions holding twenty-one stands or stacks nine high. The pipes are first subjected for about five hours to a comparatively mild heat, which is called soaking; then the full heat of the kiln is put on and continued for twelve or fourteen hours. Then the kiln is opened and the saggers taken out, with the now completed pipes. They come out white.

Fancy clay pipes are made in the same manner as common clay pipes. In the making of the more elaborate clay pipes, as, for instance, one with a bowl in the semblance of a head, more elaborate moulds may be required. As stated above, moulds of half a dozen or more pieces are sometimes used. Of course it takes more time to make such pipes, but the process followed is the same. The properties of the clays used in the manufacture of pipes are of course known, and the effect produced upon them by heat. The slate colored clays used as here described burn white; some red clays burn red and some pink, and so on.

There are some familiar shapes of clay pipes that are standard and that are sold year after year constantly in great numbers. There are some other shapes and styles that are of steady sale; and fancy clay pipes are made in great variety; popular styles of wood pipes are reproduced in clay.

There are a number of clay pipe factories in this country, none of them very large, and most of them quite small. Their total output of pipes is considerable, but it is but a very small part of the total consumption of pipes in this country, probably not more than two per cent.

Most of the clay pipes we use are imported from Germany, Holland, Scotland, and France in quantity in the order named, the greatest aggregate number coming from Germany and the greatest number of fancy pipes coming from France. There has been but little change in the clay pipe industry in this country in recent years. Under the McKinley tariff of ten cents a gross it looked up somewhat; under the present tariff of ten per cent. ad valorem it is not increasing.

ECHIUM CANDICANS.

THE handsome plant shown in the illustration and republished from The Gardeners' Chronicle, London, was exhibited at one of the May meetings of the Royal Horticultural Society, under the name of Echium formosum. The latter, however, is quite a distinct plant from the Cape, with long, tubular flowers, and has been referred to another genus under the name of Lobostemon formosus. E. candicans is a cool greenhouse plant of easy culture, attaining in time a shrubby character, and growing to a height of from 2 to 4 feet, or even higher. The blue flowers are borne in dense panicles, and have long, red, exserted filaments. The plant when in flower forms a striking object, with its silvery-gray leaves clothing the base of the stout stem. It is a native of Madeira.

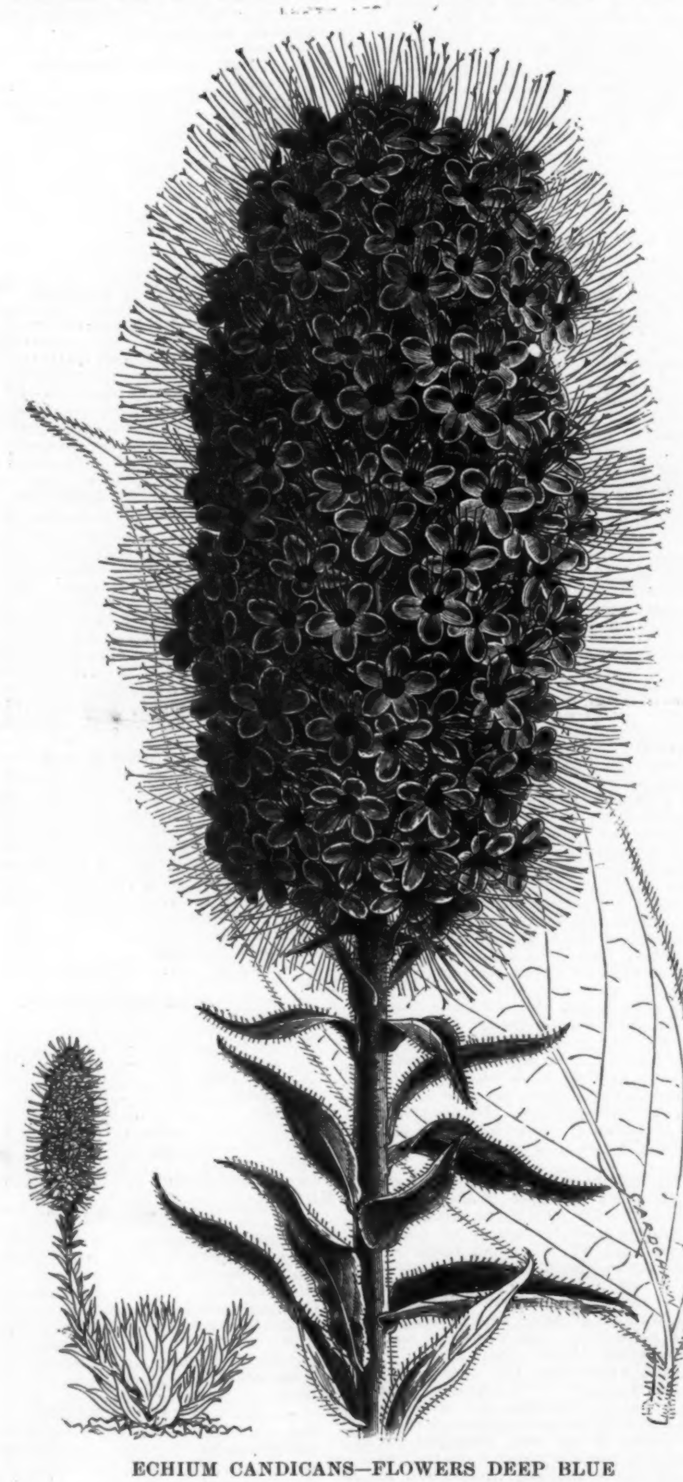
THE WALNUT IN FRANCE.

IN France it cannot be said that the walnut tree is cultivated in the ordinary acceptation of the term. In the northwestern part of France it is rarely met with, being found chiefly in the southern and southeastern part of the country, notably in the Departments of Lot, Corrèze, Isère, Drome, and Dordogne. The Departments of Drome and Isère produce what is known in commerce as the "Grenoble" walnut. The nuts which grow in the Department of Lot are given the name of the department itself; those grown in Corrèze are known as "Marbots," while the "Corne" and "Brampton" walnuts come from Dordogne. But even in these regions the acreage planted in trees is very difficult, if not impossible, to determine, for the reason that they are seldom set out in orchards. On the contrary, they are found along the roadsides, or growing in small numbers in the fields. The result is that no official statistics exist or are published regarding the acreage planted in walnut trees. Nor can the value of the land on which the trees grow be placed at any definite figure, for the reason that no land is purchased or sold especially for the growth of walnuts.

When once above ground, the French walnut tree grows rapidly. After a growth of two or three years it will produce a few nuts, from which the grower can determine what quality of fruit he can expect from the tree. In fifteen years the tree will give a remunerative crop. It may be said to arrive at maturity in from 50 to 60 years, when, under favorable conditions, an average tree will yield 220 pounds of nuts. A deep, well drained soil, situated on a hillside, with a basis of lime and granite, appears to be the most suitable for the cultivation of walnuts, and with the exception of occasional trimming, the tree requires but little care. From the first year trees are trained in the shape of a round bush, the interior of which is freed from excessive growth. Branches which appear to be developing more rapidly than the others are also trimmed or trained, in order that the tree may be well balanced. After being watched for one or two years the trees require little attention, so that little or nothing is expended in keeping them in condition. The nuts are usually gathered toward the middle of October, or sometimes at the end of September, according to the atmospheric conditions which have prevailed during the summer. Those which have fallen to the ground beneath the trees are collected in baskets, while those which still cling to the branches are beaten off with long poles. The nuts are then put in lofts or storehouses, where they are allowed to dry for a period of from two to four weeks. Unless the weather is damp, two weeks is usually sufficient.

Before the nuts are baled for shipment they are usually exposed to sulphur fumes. This has not only the effect of cleansing the shells, but acts as a preservative to the kernel.

The French walnut tree, which is one of the sturdiest that grows, seldom suffers from pests or other diseases; it lives to a great age, and dies only from decay. In departments where walnuts are plentiful, a salad oil is expressed from the kernels by a crushing process. Those who have tasted this oil once, says the United States consul at Havre, never desire to taste it again; but it is used freely by peasants who cannot



ECHIUM CANDICANS—FLOWERS DEEP BLUE

afford to buy oil of a better quality made from olives. Nut oil was also formerly used by artists for the purpose of mixing colors, but of recent years it been superseded by oil made from linseed.—Journal of the Society of Arts.

FAIRY RINGS.

By A. B. STEELE, in Knowledge.

THE green circles, or parts of circles, in pastures, popularly known as fairy rings, have given rise to many curious beliefs and sayings, and their marvelously rapid growth has struck the uncultivated as a supernatural phenomenon. The prevalent belief was that they were caused by the midnight dancing and revelry of the fairies ; and Shakespeare speaks of the elves—

> "Whose pastime
> Is to make midnight mushrooms."

In the west of England these rings are called "hag's tracks." In the myths and folklore of Sweden they are said to be enchanted circles made by fairies. The elves perform their midnight stimm or dance, and the grass produced after the dancing is called ailfexing. A belief prevails in some parts of this country that anyone treading within the magic circles either loses consciousness or cannot retrace his steps. Many absurd theories have been propounded as to the cause of these rings. Aubrey, who wrote the "Natural History of Wiltshire," in the seventeenth century, says that they are generated from the breaking out of a fertile subterraneous vapor, which comes from a kind of conical concave, and endeavors to get out at a narrow passage at the top, which forces it to make another cone, inversely situated to the other, the top of which is the green circle. Another remarkable theory by a writer, quoted in Capt. Brown's notes to White's "Selborne," attributes these rings to the droppings of starlings, which, when in large flights, frequently alight on the ground in circles, and are sometimes known to sit a considerable time in these annular congregations. It was also thought that such circles were caused by the effects of electricity, and for this belief the withered part of the grass within the circles may have given foundation. Priestley was a strong advocate of the electric theory, and was supported by many eminent men of his time.

> "So from the clouds the playful lightning wings,
> Rives the firm oak, or prints the fairy rings,"

says Dr. Darwin, and appends a note that flashes of lightning, attracted by the moister part of grassy plains, are the actual cause of fairy rings. Archæologists suggested that they might be the remains of circles formed by the ancient inhabitants of Britain in the celebration of their sports or the worship of their deities. Naturalists formerly came to the conclusion that the rings were caused by the underground workings of insects, and a few years ago a writer in the "Transactions of the Woolhope Club" attempted to prove that they were the work of moles.

These so-called fairy rings, which have long puzzled philosophers, are caused by a peculiar mode of the growth of certain species of fungi, the peculiarity being their tendency to assume a circular form. A patch of spawn arising from a single seed, or a collection of seeds, spreads centrifugally in every direction and forms a common felt from which the fruit rises at its extreme edge ; the soil in the inner part of the disk is exhausted, and the spawn dies or becomes effete there while it spreads all round in an outward direction and produces another crop, whose spawn spreads again. The circle is thus continually enlarged and extends indefinitely until some cause intervenes to destroy it. This mode of growth is far more common than is supposed, and may be constantly seen in our woods, where the spawn can spread only in the soil or among the leaves and decaying fragments which cover it. In the fields this tendency is illustrated by the formation of circles or parts of circles of vigorous dark green grass. To get at the cause, however, of the rank growth of the grass composing these rings is not without its difficulties still. It is known that fungi exhaust the soil of plant food and store it up in their own substance. In the case of these fairy rings they take up from the soil organic nitrogen which is not available to the grasses, and in some way become the medium of the supply of the soil nitrogen to the grasses forming the circle. How exactly the nitrogen, one of the most important plant foods, is fixed by these fungi has not yet been discovered ; but the grasses immediately following the fungi have been analyzed and found to contain a larger proportion of nitrogen than the herbage in the neighborhood.

Fairy rings are sometimes distinctly visible on a hillside from a considerable distance, many of them being years old and of enormous dimensions. One recorded from Stebbing, in Essex, measured 120 feet across, the grass all over it being very coarse and dark green in color, chiefly of the cock's foot species. Rings found in pasture lands are composed of several species of fungi, all of which are edible. They are most frequently observed to be formed by marasmuis oreades, a little buff mushroom which most people know under the name of champignons or Scotch bonnets. It is abundant everywhere. For several months in the year it comes up in successive crops in great profusion after rain, and continually traces fairy rings among the grass.

Another and very delicious mushroom, agaricus prŭnŭlus, sometimes called the plum agaric, and known in America as the French mushroom, occasionally succeeds a crop of champignons which had recently occupied the same site. It is sometimes found throughout the summer, but autumn is the time to look for it. The only other good edible fungi to be found in any quantity forming rings are the horse mushroom, the giant mushroom, and St. George's mushroom. The first two are excellent eating, and to be had in the late summer and autumn ; but the last are reproduced in rings in spring every year, the circle continuing to increase till it breaks up into irregular lines. The continuity of the circle is a sign to the collector that there will be a plentiful harvest next spring, while the breaking up is conclusive proof that it is going to disappear from that place. Spring is the only time it makes its appearance, and the proper place to look for it is the borders of woodlands. It is one of the most savory of mushrooms, and difficult to be confounded with any other, as it appears at a time when scarcely any other kinds occur. Like the champignon, it has an advantage over the common mushroom in the readiness with which it dries, and it is largely employed in the preparation of ketchup. It is called St. George's mushroom on account of its appearing about St. George's day, the 23d of April, and among the peasants of Austria is looked on as a special gift from that saint. In Italy a basket of early specimens is a favorite present among all classes.

WOODEN IMAGES FROM THE PHILIPPINES.

OUR engraving, for which we are indebted to the Bulletin of the Free Museum of Science and Art of the University of Pennsylvania, shows two wooden images which are now the property of the museum, having been presented by Mr. B. Howard Colkit. The images are male and female and are about 17½ and 16½ inches in height carved from single blocks of hardwood. Both have ear-rings made of brass wire and loin cloths of native fabrics with knives in wooden scabbards depending from their girdles. The male originally grasped a spear in one hand and a shield in the other. The images were made by the Igorrotes of Luzon.

PREHISTORIC MAN IN AMERICA.*

IN the year 1857 this association met for the first time beyond the borders of the United States, thus establishing its claim to the name American in the broadest sense. Already a member of a year's standing, it was with feelings of youthful pride that I recorded my name and entered the meeting in the hospitable city of Montreal ; and it was on this occasion that my mind was awakened to new interests which in after years led me from the study of animals to that of man.

On Sunday, August 16, while strolling along the side of Mount Royal, I noticed the point of a bivalve shell protruding from roots of grass. Wondering why such a shell should be there, and reaching to pick it up, I noticed in detaching the grass roots about it that there were many other whole and broken valves in close proximity ; too many, I thought, and too near together to have been brought by birds, and too far away from water to be the remains of a musk rat's dinner. Scratching away the grass and poking among the shells I found a few bones of birds and fishes and small fragments of Indian pottery. Then it dawned upon me that here had been an Indian home in ancient times and that these odds and ends were the refuse of the people—my first shell heap or kitchen midden, as I was to learn later. At the time this was to me simply the evidence of Indian occupation of the place in former times, as convincing as was the palisaded town of old Hochelaga to Cartier, when he stood upon this same mountain side more than three centuries before.

The anthropologist of to-day would hardly venture to do more than to make the most general statement of the characters of any race or people from the examination of a single skull, although after the study of a large number of skulls from a single tribe or special locality he would probably be able to select one that was distinctly characteristic of the special tribe or group to which it pertained.

It must be admitted that there are important considerations both physical and mental that seem to prove a close affinity between the brown type of eastern Asia and the ancient Mexicans. Admitting this affinity, the question arises, could there have been a migration eastward across the Pacific in neolithic times, or should we look for this type as originating in the Eurafric region and passing on to Asia from America? This latter theory cannot be considered as a baseless suggestion when the views of several distinguished anthropologists are given the consideration which is due to them. On the other hand, the theory of an early migration from Asia to America may also be applied to neolithic time.

However this may have been, what interests us more at this moment and in this part of the country is the so-called "mound builder" of the Ohio Valley. Let us first clear away the mist which has so long prevented an understanding of this subject by discarding the term "mound builder." Many peoples in America as well as on other continents have built mounds over their dead or to mark important sites and great events. It is thus evident that a term so generally applied is of no value as a scientific designation. In North America the term has been applied even to refuse piles ; the kitchen middens or shell heaps which are so numerous along our coasts and rivers have been classed as the work of the "mound builder." Many of these shell heaps are of great antiquity, and we know that they are formed of the refuse gathered on the sites of the early peoples. From the time of these very early deposits to the present such refuse piles have been made and many of the sites were reoccupied, sometimes even by a different people. These shell heaps therefore cannot be regarded as the work of one people. The same may be said in regard to the mounds of earth and of stone so widely distributed over the country. Many of these are of great antiquity, while others were made within the historic period and even during the first half of the present century. Some mounds cover large collections of human bones ; others are monuments over the graves of noted chiefs ; others are in the form of effigies of animals and of man ; and, in the south, mounds were in use in early historic times as the sites of ceremonial or other important buildings. Thus it will be seen that the earth mounds, like the shell mounds, were made by many peoples and at various times.

There are, however, many groups of earthworks which, although usually classed as mounds, are of an entirely different order of structure and must be considered by themselves. To this class belong the great embankments, often in the form of squares, octagons, ovals, and circles, and the fortifications and singular structures on hills and plateaus which are in marked contrast to the ordinary conical mounds. Such are the Newark, Liberty, Highbank, and Marietta groups of earthworks, the Turner group, the Clark or Hopewell group, and many others in Ohio and in the regions generally south and west of these great central settlements ; also the Cahokia mound opposite St. Louis, the serpent mount of Adams County, the great embankments known as Fort Ancient, which you are to visit within a few days, the truly wonderful work of stone known as Fort Hill in Highland County, and the strange and puzzling walls of stone and cinder near Foster's Station.

So far as these older earthworks have been carefully

WOODEN IMAGES—HEIGHT, 16½ AND 17½ INCHES—IGORROTES OF LUZON, PHILIPPINE ISLANDS.

* Abstract of an address before the Columbus, Ohio, 1899 meeting of the American Association for the Advancement of Science, by Dr. Frederick Ward Putnam.

investigated, they have proved to be of very considerable antiquity. This is shown by the formation of a foot or more of vegetable humus upon their steep sides, by the forest growth upon them, which is often of primeval character, and by the probability that many of these works, covering hundreds of acres, were planned and built upon the river terraces before the growth of the virgin forest.

If all mounds of shell, earth, or stone, fortifications on hills, or places of religious and ceremonial rites, are classed irrespective of their structure, contents, or time of formation, as the work of one people, and that people is designated "the American Indian" or the "American race," and considered to be the only people ever inhabiting America, north or south, we are simply repeating what was done by Morton in relation to the crania of America—not giving fair consideration to differences while overestimating resemblances. The effort to affirm that all the various peoples of America are of one race has this very year come up anew in the proposition to provide "a name which shall be brief and expressive," and at the same time shall fasten upon us the theory of unity—notwithstanding the facts show diversity—of race.

In connection with the art of the builders let us consider the earth structures themselves. The great mound at Cahokia, with its several platforms, is only a reduction of its prototype at Chalula. The fortified hills have their counterparts in Mexico. The serpent effigy is the symbolic serpent of Mexico and Central America. The practice of cremation and the existence of altars for ceremonial sacrifices strongly suggest ancient Mexican rites. We must also recall that we have a connecting link in the ancient Pueblos of our southern States; in comparatively recent times, there were a few remnants of this old people. It seems to me, therefore, that we must regard the culture of the builders of the ancient earthworks as one and the same with that of ancient Mexico, although modified by environment.

Our northern and eastern tribes came in contact with this people when they pushed their way southward and westward, and many arts and customs still linger among some of our Indian tribes. It is this absorption and admixture of the peoples that has in the course of thousands of years brought all our American peoples into a certain conformity. This does not, however, prove a unity of race.

The public need no longer be deceived by accounts of giants and other wonderful discoveries. The wares of the mercenary collector are at a discount, since unauthentic material is worthless.

Anthropology is now a well established science, and with all this wealth of materials and opportunities there can be no doubt that anthropologists will in time be able to solve that problem which for the past half century has been discussed in this association, the problem of the unity or diversity of prehistoric man in America.

THE BEGINNING OF THE SCIENCE OF PREHISTORIC ANTHROPOLOGY.*

THE first practical scientific investigation on this subject was done in Denmark. Up to the beginning of this century the science of prehistoric anthropology had been an unknown one. Prior to that time the origin of man and his first occupation of the earth had belonged either to history (which, as a matter of course, only went back as far as the invention of the alphabetic signals), or else it was detailed in tradition. In 1806, in Denmark, the beginning of this science took place. The king organized a commission to investigate the surface of the earth in his kingdom. He appointed a zoologist, a geologist, and an archæologist; and the three started over the work. About the first thing they struck which caused them to put on their studying caps was what was called a dolmen. With all the wealth of ornaments we have here in the State of Ohio the dolmen itself is not known. A dolmen is a chamber or chambers (maybe many chambers) built of large, rude stones. Those which form the sides of the building are set on edge; and having been completed all round, with an opening at one end, a covering stone is put on top. Some of these have as many as six chambers; most of them but one. Of these immense stones I may say none weigh less than a ton, while 10, 20, and 40 tons are not at all unusual.

This Danish commission came to an investigation of one of these dolmens. They found some of them had been opened in the early times (no one knew anything about any prehistoric time); others of them were intact. Opening some of the intact dolmens they discovered, to their surprise and astonishment, that some of them contained the skeletons of man, and they determined them to be burial places; and, buried along with them, were stone jars, arrowheads, pieces of pottery, etc. Similar objects had been found scattered throughout the country and had been recognized as supernatural, the stone hatchets and arrowheads having been called by their ancient name of thunder stones or lightning stones, believed to have come from the heavens in a stroke of lightning or a clap of thunder. A man whom I once met, and who held one of these stone hatchets in his hand, declined to give it up for any purpose or for any price whatever; because it was held by him, and by the country generally, to be a charm against fire. He said that he had seen this particular specimen come down from heaven in a flash of lightning; that it struck in the field adjoining his house and that he went over there and found the stone still hot. If you went through that country, not alone Denmark but anywhere through western Europe at that time, and among the peasants even down to the present time (it was so when I lived in that country)—if you went among the peasants there and asked to see any of the prehistoric hatchets, or arrowheads, or what not (the things of which you have so many up and down this Scioto Valley), they knew not what you meant; you would have to ask for the thunder stones or lightning stones. Then they would immediately fetch them out, and you would find that they were regarded as charms. Some of them are put by the side of the fireplace, in the thatch of the roof, or at the entrance of the door (over and under it), and are supposed to be charms and amulets that have supernatural power, the chiefest of which is protection from fire.

The gentlemen of this committee on opening this dolmen—this tomb—found these same objects; and it became gradually impressed upon them that the usual explanation of them had no truth whatever, but on the contrary, they were the fabrication or handiwork of man, and that to whatever period of the history of that country they belonged, however ancient it might be, it only indicated that man existed in that period, occupied the country and made and used these instruments; and it was gradually forced upon them that these were the tools that man made and used. It took about ten years for this proposition to filter through the minds of the people, and in 1816 they got together the objects that had been gathered by this commission and founded what is now the great Archæological Museum of Copenhagen. At that time the science of prehistoric anthropology was born — though hardly then; because these gentlemen, in the further pursuit of their duties, found mounds or hillocks along the coast of the country, and pretty nearly all the way around; some of them were regarded as natural soil—many of them were; and the geologist accepted that at first; but when he found that the peasants were digging into these mounds and found rich earth which they were carting out upon their fields as they do muck and marl to improve the soil, they were compelled to abandon that belief and turn their investigation to these mounds or hillocks. They were hardly to be called mounds: they would not correspond, at all, with the mounds that we have in this State: but they were enough to justify even the man who was a professional geologist in the belief upon their first appearance, that it was the natural soil: yet digging into them they found that the principal composition (or a large proportion of it, at least) was the shells, chiefly oysters, that belonged in the ocean in the neighborhood. They also found in them the same implements that had been discovered in the dolmens: and gradually the idea grew in their minds that these mounds were also the result of human handiwork: and when that thought became apparent, the science of prehistoric anthropology was born.

This discovery created considerable interest throughout the world and throughout that country; and the implements that had been found, and descriptions of them, were scattered generally throughout France and Germany, and all western Europe; and the people who lived in these other countries discovered, to their surprise, that the same objects which had been found in Denmark belonged to their own countries and were there to be found; that they had existed there and they had believed them to be the work of fairies and everything else of that kind, assigning to all a supernatural character and calling them still the pierre de tonnerre and pierre de foudre. So there spread generally a belief among the students of the age, not the peasants at all; for the peasants, to a very great extent, have not yet admitted that these were the handiwork of man; but the students of the science became satisfied that the same tools that they were accustomed to see in the hands of the peasants and to find in the fields throughout those countries were the same as those discovered in Denmark by this commission and ended in recognizing them as the handiwork of man. So this went on until about 1853-54, when the particularly low water in the Swiss lakes brought to light a large flat of shore formerly covered with water, but now brought to surface so that it could be examined. Dr. Kellar, who, upon this drying up of the lake, made the examinations and found there that what had been for years and years charged as a submerged forest, and as such had been execrated by the fishermen because the stumps still stuck up and caught their nets when they dragged them to shore—found that these objects were not stumps at all; that they were piles that had been sharpened with axes to a point and then driven in; and that when he came to draw them out they showed that they had been made by man. He noticed that they were laid out in regular rows and squares and covered over acres in area; and then, too, was discovered the fact that there had been a human occupation of that country in the prehistoric times, long before there had been any knowledge of the existence of man: they found that these had been piles that stood above the water and had been leveled off and floors put upon them and buildings erected; and upon a search of the bottom of the lake they discovered the implements, some of which had been lost, and some where the buildings had been burned and the whole floor been thrown to the bottom; and then the whole industry, the technology, of the district was preserved by being charred and then put under water, never to be brought to light until at this period. It was as though there had been a resurrection; and Dr. Kellar found thousands, hundreds of thousands, of things which were thus rescued.

Putting the two together, the discoveries in the dolmens of Denmark and at the bottoms of the Swiss lakes, the investigators soon came to the conclusion that there had been a prehistoric human occupation; and then the science of prehistoric anthropology was put on a firm basis.

Eighteen hundred and fifty-three and four was the date of this last discovery. In 1859 there was another discovery. Let me go back to a little beginning with regard to that. A man who, though a very prolific writer, was not a scientist, who lived north of Paris in the town of Abbeville in about the year 1828, was investigating, for his own amusement, and as an amateur, some excavations going on in the building of some ramparts. The government was putting up some ramparts for the protection of the city, and it was necessary to cut some canals for the bringing up of the timbers and transportation of the earth and stone. "In this," says Boucher de Perthes, "it came to me, suppose we should find some of the stones here that were evidently made by man?" He carried that thought; and while there was no testimony justifying that kind of conclusion, yet with that thought before him he continued his investigations. It was not until 1836 that he obtained the necessary evidence that settled into a conviction.

From 1836 down to about 1859, there were all kinds of discussions. The French geologists and mineralogists took ground very strongly against him; many of the British scientists did the same; but at last Dr. Falconer visited Abbeville, made some of the discoveries himself and reported them back to London with such favor that a party of English geologists and mineralogists made it a visit, which resulted in a meeting of English and French scientists, in about equal numbers, fifteen in all, who repaired to the place and made a personal investigation which ended, at last, in each one satisfying himself that his former position was correct, and they divided upon about equal terms. But, curiously enough, the English geologists decided in favor of the authentic, prehistoric handiwork of the tools and implements found, while the Frenchmen, as a rule, had it the other way. That only lasted for a little time. They were drawing the lines at that time; both sides came nearer together, and by the pursuit of the facts and bringing the antagonists together at the gravel pits, and making investigations in their immediate presence, they soon became satisfied. Before the year was out the opposition had yielded, and it was admitted that these tools and implements were human handiwork, evidences of the presence of man at a very much earlier time than had ever before been suggested.

These investigations continued, spreading all over France, indeed, all over western Europe, until the places could be counted by the hundreds and the implements by the thousands, all, practically, made of flint and stone by chipping. These were christened by Sir John Lubbock as palæoliths, and the age to which they belonged was the age of stone, called by him the palæolithic age, meaning the older stone age, the characteristic of which was that the instruments were made by chipping—by flaking—and not by grinding or polishing. The majority of the implements found in Denmark and in the Swiss lakes had been finished by being rubbed one stone against another until they were either smooth or sharp, or both; while of those discovered at Abbeville and at the other hundreds of places, numbering thousands of implements, none were thus smoothed or ground. Many of them were water-worn quite smooth, but none of them had the smooth and regular character given by the grindstone.

At that time began the foundation of the schools or societies of prehistoric anthropology: the science was recognized as being a science. If the divisions or subdivisions were uncertain or disputed, the existence of the science itself was recognized as indubitable. The announcement in the same year by Darwin of the discovery of the origin of species by evolution gave a great impetus to the new science. Many of the scientists—biologists, anatomists, doctors, and so on, not at all posted with regard to, or who took little interest in, flint hatchets or in flint working—became intensely interested in the subject of prehistoric anthropology, because of its relationship to the discovery of Darwin; and the newly established societies at London and at Paris included nearly as many of these doctors, anatomists, and biologists as of either archæologists or naturalists.

From that side of the science then they started an investigation into the different characteristics of the human skeleton. The Neanderthal skull had just been discovered; the Canstatt skull had been discovered in the early part of the eighteenth century; but these and others that were subsequently found were brought together, and it was sought to be determined by the anatomists what manner of man this prehistoric man had been, and very intricate and elaborate calculations were made. Contours were drawn, pictures and comparisons were made, etc., the details whereof it is needless to state, but which were very interesting to the men making them.

About that time there came a new wave of investigation. Quite a number of French and some English gentlemen had made discoveries of objects found deep down in the pliocene which they believed had been the handiwork of man. If that proposition could be proved, it would tend to show that man had lived at a time the distance of which was immensely greater than anything known before. There was a wide discussion. It began before the International Congress of Prehistoric Archæology and Anthropology in 1872, and continued for four or five consecutive meetings. Abbe Bourgeois was one of the most persistent advocates of man in the tertiary period. In the tertiary deposits in the neighborhood of Thenay he found a number of flint implements. I have seen them. If they had been found on the surface anywhere through the valley of the Scioto, in any of the mounds or graves of Ohio, nobody would doubt but that they had been made by man; but, finding them in what was regarded as undisturbed ground, of the tertiary period, was a different question, and it begat a great discussion. Other evidences of tertiary man have been found, for example, by Sig. Capillini, who has them in his museum at Bologna, Italy. They are the bones of a species of whale which had been cut and carved as though with a knife. It is an extinct animal, exclusively found in deposits which would carry it to the tertiary.

The principal points that have been raised in opposition were that the objects were not found in their original deposit, that the deposit had been disturbed, or that it was not of the age to which it was attributed, or that the objects were not made by man. I suppose that the discussions taking place over that subject have been continued for such a number of years that at last both sides have been worn out and nothing has been decided with regard to it. The last that I know of that has been done on the subject was by Sir John Evans in his address before the British Association for the Advancement of Science, in which he takes strong ground against it. It is one of those questions which, like a great many other problems of prehistoric science, must be regarded as unsettled, and has to be laid away to await further developments.

In 1894 Dr. Dubois, a physician in the army of the Netherlands, a talented and learned young man, was much interested, as are a great many of the professional scientific men in Europe, in the subject of prehistoric anthropology (anthropology first and prehistoric anthropology second); and he, for some reason, was assigned with his army to duty in the Dutch colony of Java. He went out there and remained six years. There had been considerable discoveries made in that island, those made particularly by Prof. Martin, who had found many fossil bones of the tertiary period, brought them to Leyden and had displayed them in the museum of which he is a director. This probably, more than from anything else, gave the idea or hint to Dr. Dubois to pursue his investigations in

* By Prof. Thomas Wilson, of the Bureau of American Ethnology, Washington, D. C., being his vice-presidential address before the Section of Anthropology of the American Association for the Advancement of Science, delivered at Orton Hall, Columbus, Ohio, August 21, 1899. Reported especially for the SCIENTIFIC AMERICAN SUPPLEMENT.

that island; he did so, and for three successive years he dug in the strata of a stream called Tinil. The second year he found a femur of what was said to be a human. The third year he found the skull, or at least the skull cap, of what was said to be a human. These were about fifteen meters apart; one was found one year, the other the next. There was the piece of an under jaw and certain teeth. When the news thereof was published and photographs taken and reproduced throughout the country, everybody said without any question, "Why, that is simply a piece of the human skeleton." It was easy enough to say that. Nobody could dispute it; and it would require a good deal of force, at least, and faith, to stand up and successfully contend against the declaration. But there is another side to it (as there are always two sides to a question), and one side may be very good until the other is told. Dr. Dubois, in his excavations there, found, I should say just at a guess (I cannot do more than that), what would make in the neighborhood of four wagon loads of fossil bones, fossilized until they were twice their original weight. He brought those all home with him; and this skull and this femur were found in the midst of this deposit—a deposit that was three or four to six feet thick, and that spread over an area twice or three times as large as this room. He has not completed the results of his investigations, and nobody knows yet what kind of animals these all are; but the stegodon, one of the early elephants, is among the principal animals of that deposit. There are also the stag and the horse, and so on. I should say that he has enough there, when spread out, laid on their tables and in other places, so that they can be assigned each one to its respective place, to cover the floor of this entire building.

In the midst of this deposit these particular human objects were found. If it was human—if these objects were actually human and belonged to a human individual—then the human side, man as a species, is of the same epoch, is of the same age, as the deposit in which these bones were found. Dr. Dubois is not of that opinion; he thinks that this was a being midway between man and ape, and the missing link so often and long talked of.

I confess that my faith in the belief that this was merely a part of a human skeleton was immensely shaken when I came to see the locality in which this was found and the objects with which it was found associated. When they are segregated, divided, separated out to their different classes, investigated, and it is shown to what races they belong, then we will be better able to determine the value of the find made by Dr. Dubois.

My time is exhausted, though my subject is not. The story of the beginnings of the Science of Prehistoric Anthropology is too extensive for treatment within the limits of a single address. It is sufficient to fill an entire course of lectures. Without trespassing on your patience at the close of a day containing eight other addresses than mine, I stop without approaching the end.

NEW PHOTOGRAPHIC APPARATUS.

IN photography, novelties, properly so called, are becoming rare, although improvements that are appreciated by amateurs are making their appearance every day. Some of the most interesting of these we now propose to describe.

The fact is well known that, in most cases, in order to take views of somewhat tall buildings, it becomes necessary to incline the camera; whence result distortions in the perspective. In other cases, the complaint is made that it is impossible to take views of some little extent with a simple twin lens camera. Both of these difficulties have just been surmounted by M. H. Mackenstein, the inventor of a stereoscopic camera which is now well known. This apparatus has recently been improved by M. Mackenstein in such a way as nearly to double its field of exploration without inclining it, and without any distortion, by converting the stereoscopic camera momentarily into a simple one. In this case a single objective is used.

Through the motion of a slide that carries the objectives, one of the latter is brought to the very center of the apparatus. The consequence of such a change may be imagined. In ordinary stereoscopic practice, two plates are used for each exposure. The elongated

FIG. 1.—STEREOSCOPIC CAMERA, WITH ITS OBJECTIVE IN THE CENTER, FOR TAKING PANORAMIC VIEWS.

F, objective to the left, out of center; F', objective to the right, covered; H, H', movable portion of the magazine.

rectangular magazine contains one plate for the objective to the right and another for the one to the left. Now, it is clear that if for these two plates we substitute a single one of double size, and the single objective be arranged exactly in the center so as to cover it well, we shall have formed a new apparatus that will permit of doubling the field. The objective performs the part of a large ocular. The size of the single plate is 3×7 inches. It can be used vertically for tall buildings and the interiors of churches, etc., and horizontally for panoramic views.

It is unnecessary to say that this new device will give amateurs a means of reproducing upon the same negative a whole series of subjects that would escape an ordinary apparatus, such as bass-reliefs, friezes, colonnades, etc. The exceptional size of the plate, moreover, will not prevent the negatives from being used for projections. It suffices, in fact, to bring the negatives to the "congress size" with the camera in order to obtain images that will unite the details and field of the two stereoscopic negatives in a single positive, and this time with their true perspective. The new system, therefore, offers evident advantages.

Another stereoscopic apparatus that must be mentioned is one in which the ordinary finder is replaced by a magnifying glass that permits of focusing with great precision. When a stereoscopic camera is used

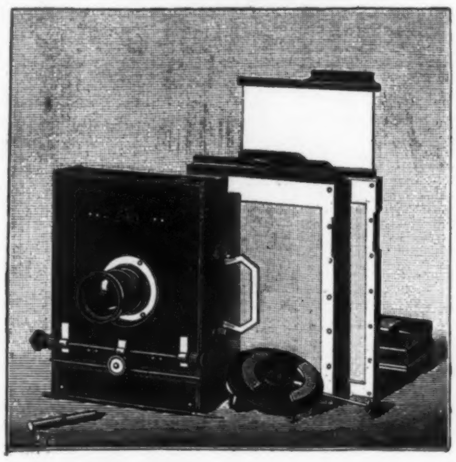


FIG. 3.—"PAPILLON" APPARATUS, CLOSED.

Frame, disk for fixing the camera, and the tripod folded.

for taking simple views, it is often necessary to do accurate focusing that cannot be effected through the aid of the finder. In such a case, M. Mackenstein employs a magazine divided into two parts, one of which is a drawer containing eighteen plates and the other a free compartment provided with a plate of ground glass and an external lens. One of the shutters (that to the left) is allowed to remain open, and an objective is provided that is to operate as a graduating shutter. The objects in motion are watched upon the ground glass by means of the lens, and, when they are exactly in focus, the shutter to the right is freed. In this way there is a certainty of obtaining sharp negatives.

We shall now mention an apparatus that will satisfy those who do not like to carry heavy weights. The practice of instantaneous photography prevails among tourists and others, who, nevertheless, would often be very glad to have recourse to more lengthy exposures and to obtain negatives of large size. But the apparatus for such a purpose is heavy and cumbersome, and the idea of carrying it is, in most cases, abandoned after due reflection. M. Alfred Alexandre, mindful of those whose shoulders are sensitive and who detest heavy apparatus, has been led to construct cameras and frames of aluminum. The result of such an innovation is quite important. With an ordinary 5×7 inch apparatus, it is necessary for a person to carry more than four pounds, while with the new one, the "Papillon," he carries but about a pound and three-quarters. Such a difference in weight will be easily seen at the end of the day, especially if the sun has been shining. In the Papillon, everything is of metal except the

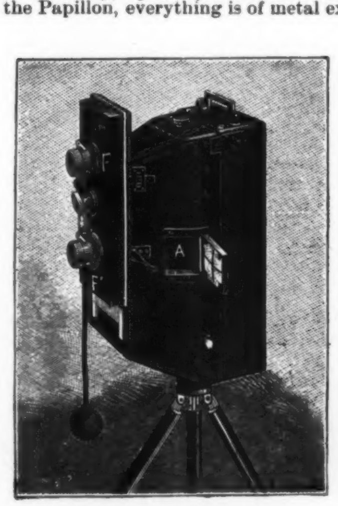


FIG. 2.—TWIN-LENS CAMERA, ARRANGED VERTICALLY.

bellows, and so the apparatus is well adapted for use in warm countries.

The front cover serves as a table for the tripod, the wooden legs of which are very light and are strengthened at the joints with strips of aluminum. This tripod is 16 inches in length when folded up and $4\frac{1}{4}$ feet when opened out. The objective is carried by a plate that slides up and down in a frame supported by oblique slotted rods.

The upper extremity of the legs of the tripod are united by a metallic disk, and two sectors that recede from or approach each other under the action of a screw enter an aperture in the table and fix the camera firmly upon the tripod.

With such an apparatus slung over the shoulder, a person can take a long walk and easily return with his twelve 5×7-inch plates well covered.

For the above particulars and the illustrations, we are indebted to La Nature.

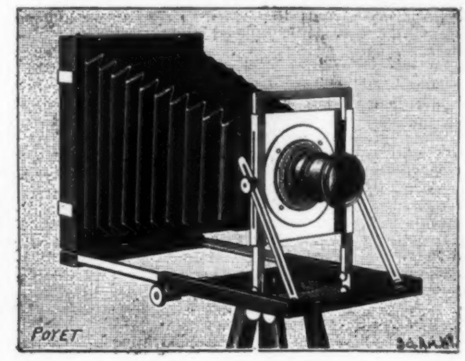


FIG. 4.—"PAPILLON" APPARATUS IN POSITION.

UNUSUAL FOOD.

LION flesh is said to be very good eating, but tiger is tough and sinewy. Nevertheless, the latter is eaten in India, as there is a superstition that it imparts strength and cunning to the eater. Bear's flesh is a great favorite in Germany, and smoked tongues and hams are considered great delicacies. On account of the rarity of Bruin, they are expensive. Sausage—so dear to the Teutonic heart and stomach—is also made from bear liver; twenty-five pounds of sausage can be made from a single liver.

According to The St. Louis Globe-Democrat, there appears to be considerable diversity of opinion as to the merits of elephant's flesh. In India and Africa it is a favorite dish with the natives, but a European who has traveled much in Africa says: "I have tasted elephant over and over again. It is more like soft leather and glue than anything I can compare it to." Another traveler, however, declares that he cannot imagine how an animal so coarse and heavy can produce such delicate and tender flesh. All authorities, however, agree in commending elephant's foot. Even the traveler quoted above, who compared elephant's flesh to leather and glue, admits that "baked elephant's foot is a dish fit for a king." When an elephant is shot in Africa, the flesh is cut into strips and dried; it is then called "biltong." The elephant's foot is cut off from the knee joint, and a hole about three feet deep is dug in the earth and the sides of it baked hard with burning wood. Most of these faggots are then removed, and the elephant's foot placed in the hole. It is filled up with earth, tightly packed down, and a blazing fire built on top, which is kept burning for three hours. Thus cooked, the flesh is like a jelly, and can be eaten with a spoon. It is the greatest delicacy which can be given to a Kaffir.

Rhinoceros meat is something between pork and beef, and is not to be despised when no other flesh is to be obtained. In America a 'possum is esteemed a great delicacy. Kept in a barrel for a week and fed on sweet potatoes, and, when killed, stuffed and roasted, it forms a most delicate dish, resembling chicken in taste. A negro will spend all the night catching a 'possum for his Sunday dinner.

Monkey meat is also good eating. Dr. Wallace, the well-known scientist, once breakfasted on monkey. "It was by no means bad," he wrote, "being something like rabbit." He also stated that: "Although the habits of the jaguar are filthy in the extreme, jaguar steaks are beautifully white and remarkably like veal in taste."

In the same way ducks, though feeding on grubs, worms, frogs, and mud, form, as every one will admit, a delicious dish. Kangaroo steaks are splendid, and our Australian cousins assert that kangaroo soup is the finest in the world, and infinitely superior to ox-tail. Travelers are also unanimous in declaring that the flesh of the alligator and crocodile is extremely tender, white, and delightful to the palate. Seal flesh, though perfectly black, is matchless for flavor, tenderness, digestibility, and for heat-giving power. Squirrels are extensively eaten in some parts of rural England. Skewered nightingales is the great dish of Florence, and those who have conquered their sentiments and eaten the little songsters are loud in their praises. In Florida a stew of robins, jays, and bluebirds forms a most savory and delicate dish, and if you did not know the names of the dishes, you could eat and enjoy rat pie, stewed cat, boiled horse beef, fried snails, or any of the above dainties. As it is, the imagination is the autocrat of the stomach, and people will only eat what custom has made familiar. There is no reason—beyond that of custom—why man should not add some of the above dainties to his bill of fare.

THE PRESENT POSITION OF THE INVESTIGATION OF THE MALARIAL PARASITE.

THE rôle played by the mosquito as a carrying agent of the malarial parasite from man to man seems to be restricted to one genus, the Anopheles. Major Ross, of the Liverpool School of Tropical Diseases, in a telegram from Sierra Leone, announces the fact that he had found the Anopheles there, and that it may be the intermediary host of the quartan malarial fever.

Many observers in different countries, noticing the fact that malaria is most prevalent at the most active period of mosquito life, have attributed malaria to the agency of this insect. Dr. Patrick Manson, in 1894, first brought the subject forward in England, and, acting on his suggestion and advice, Major Ross undertook an investigation in India.

In 1897, by using two species of Anopheles, Ross traced the malarial parasite into the wall of the stomach of the mosquito after it had fed on patients

whose blood contained the crescentic gametocytes; the next year he succeeded in tracing the complete life history of the proteosoma Grassii Labbé of sparrows, and showed that its intermediary host was one particular kind of mosquito, the Culex pipiens. The gametocytes contained in the red blood corpuscles of the vertebrate host pass with the blood into the stomach of the mosquito, and passing through the stomach wall bulge into the body cavity; here a sexual process takes place, zygotoblasts are eventually formed, which pass into the insects' blood, and finally find their way into the salivary gland and to the duct leading from this to the extremity of the stylet; from here they escape into the blood of the vertebrate host when the insect bites.

Following on these results, Grassi in Italy attacked the problem from another point of view; he studied the mosquitoes prevalent in the different parts of the country where malaria occurs. The results were interesting. He found there was no indigenous malaria where the Culex pipiens was common, but it did occur where the large mosquito Anopheles was found.

Bignami and Bastianelli, who had been trying unsuccessfully to infect a man by allowing mosquitoes to bite him, attributing their want of success to the use of the wrong kind of mosquito, and, acting on the observations of Grassi, tried again with some mosquitoes imported from a malarious district. This time they succeeded in infecting the man with malaria of the same type that prevailed in the district from which the mosquitoes came. Moreover, they have shown that the development of the human form of parasite in the body of Anopheles is identical with the development of the proteosoma of birds in Culex pipiens, as observed by Ross.

According to these observers, the species Anopheles claviger is the most common intermediary host of the parasite of malaria in Italy, the tertian and summer-autumn types.

It is evident that the next step in the study of malaria should be to hunt for the different species of Anopheles and see if these are the intermediary hosts of the different types of malaria throughout the world, and what particular species is most concerned in transferring the parasite from man to man. Grassi has done this for Italy, and now we hear that Ross has found a species of Anopheles to be concerned in the transference of quartan fever; thus all the types of malarial fever are now referred to the Anopheles as their intermediary host. His full report on return from Africa will be read with interest.

Whether the Anopheles can be extirpated from a locality, and by what means, will be the problem for scientific workers resident abroad to settle; fortunately they seem to be confined to small areas, so the suggestion of Ross to draw off the water from stagnant pools may not be so hopeless a task as it would at first appear.—Nature.

CALORIMETER FOR THE HUMAN BODY.

THE apparatus is a large Berthelot calorimeter. A wooden chamber, covered outside with felt and inside with cotton wool, contains a chamber of copper, carefully polished on the inside, 145 cm. high, 60 cm. wide, 810·4 liters capacity, weighing 62·37 kg. A rise of 1° C. in the temperature of the mass of copper would represent 5,832 gramme-calories. The annular space between the two chambers has a breadth of 5 cm. The chambers are closed by a movable panel and a door, manipulated with the help of a tackle. Two fans, one fixed low down in the chamber, the other high up, drive the constantly circulating air through the tin vessel containing the ice, suspended from the ceiling of the chamber; the whole of the air of the chamber is carried through the calorimeter in about two minutes. The thermometers are divided into fiftieths of a degree. As a human body gives out about 90,000 calories during one hour (duration of one experiment), a rise of 1° C. in the temperature of the air in the chamber, amounting to 214 cal., is not of much consequence. The heating of the mass of copper is more to be feared; but the temperature of the copper could easily be maintained within 0·3°. The heating of the revolving fan bearings proved insignificant; the heat generated by the friction of the blades against the air was determined by special experiments: it amounted to about 6,000 cal. for 200,000 revolutions of the fans, which were driven by electric motors, and made together from 1,000 to 3,000 revolutions per hour. Determinations of the heat lost in the chamber by a 6-liter jar filled with hot water differed by 8 per cent., because the vessel could not be placed in position and taken out again with sufficient rapidity, and for other reasons. The burning of a jet of hydrogen in the chamber gave more concordant results; the mean found is 34,428 cal. per gramme of H (34,462 Favre and Silbermann).

The chamber seems well suited for its purpose, as the subjects could spend an hour in it without experiencing any discomfort. The subject sitting on a stool close to the calorimeter felt neither draught nor perspiration nor want of air. The sublingual temperature fell slightly, by about 0·2° (0·45° maximum); but the same falling off was observed on sitting quietly in an ordinary room. 5 kg. of ice or more were cut into blocks of 2 or 3 inches diameter. The number of calories given out by one person varied for one subject (26 experiments) between 122,124 and 80,639 cal. per hour. Most of the tests were made after lunch; the influences of age, weight, a heavy meal, fasting, warm clothing, etc., have not yet been studied sufficiently. In a general sense it may be said that 4,000 cals. are produced per gramme of oxygen absorbed. These are the means of 36 experiments with three different subjects. But the values varied between 3,292 and 5,031 for one person, and there is no proportionality. This want of proportionality may be due to a storage of oxygen in the tissues. In some cases fresh air was inspired through the nose and expired through the mouth, and carbonic dioxide determinations were made. The variations stated in this abstract are the largest observed, and concern one of the authors, age 69 years, weight 58 kg.—H. B.—W. Marcet. Heat evolved by the Human Body. W. Marcet and R. B. Floris. (Roy. Soc. Proc. 63, pp. 232–242, 242–255, 1898).—From Science Abstracts.

The hydraulic power plant at Sault Ste. Marie, Mich., will have a capacity of 40,000 horse power.

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